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ABSTRACT

Project WILD is the first large-scale curriculum supplement focusing on wildlife concepts and integrated with many areas of the general school curriculum. It features decision-making processes and explores a diversity of attitudes toward wildlife. The goal of Project WILD is to prepare young people to make decisions affecting people and wildlife and their shared home, the earth. Project WILD addresses the need for human beings to develop as responsible members of ecosystems. This resource guide is written for grades 3-8, but can be adjusted to any grade level. It provides background information and a selection of activities to help develop a unit on endangered species in Massachusetts; however, the activities are such that they can be applied to any region of the United States. Major concepts include the following: all living things are interconnected; animals and plants have basic needs of food, water, shelter, and living space for reproduction; animals and plants are vulnerable to extinction if their habitat is destroyed; some animals and plants that were almost extinct have made a recovery; humans can make a difference; and the diversity of plants and animals on the earth is essential to the quality of life for humans. Appendixes include a history of the endangered species law; a list of teacher resources and resources to enhance and support the study of endangered species; and a list of Massachusetts endangered, threatened, and special concern species. (AIM)

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The Massachusetts Audubon Society

project WILD

in Massachusetts

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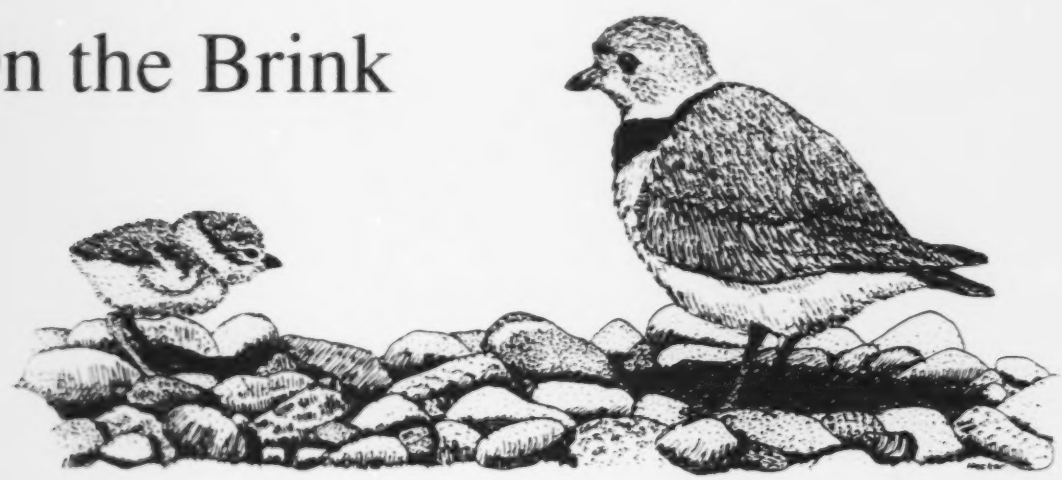
On the Brink



Activity and Resource Guide to Teaching About Massachusetts Endangered Species

Cleti Cervoni, Editor

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On the Brink:

An Activity Guide to Teaching About Massachusetts Endangered Species

Cleti Cervoni, Editor
November, 1993

Funding for this publication provided by:

Veryfine

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This activity and resource guide is a joint publication of the Massachusetts Audubon Society, the Massachusetts Division of Fisheries and Wildlife, and Project Wild in Massachusetts.

The Massachusetts Audubon Society is a voluntary association of people with a common concern—the preservation of an environment that supports both wildlife and people. The Society is one of the oldest conservation groups in the world and the largest in New England. Its programs encompass three broad areas: conservation, education, and advocacy. As an independent state Audubon Society, the primary focus of its activities is Massachusetts.

Division of Fisheries & Wildlife

Founded as a Fisheries Commission in 1866, the Massachusetts Division of Fisheries and Wildlife has been responsible for managing and restoring the Commonwealth's fish and wildlife for over a century. The Division regulates sport hunting, trapping and fishing and conducts research designed to ensure that management and restoration programs reflect the most up-to-date information for each wildlife species or habitat type.

The Division's programs are supported by revenue from the sale of hunting, trapping and fishing licenses, returns from federal taxes on hunting and fishing equipment, and voluntary donations through a "check off" line that has appeared on state tax forms since 1983. This money supports wildlife management, research, restoration projects and acquisition of lands for wildlife habitat.

The Division of Fisheries and Wildlife operates under the auspices of an independent seven-member regulatory board appointed by the Governor. Administratively, the Division is a part of the Department of Fisheries, Wildlife and Environmental Law Enforcement.

project WILD

in Massachusetts

Project WILD is the first large-scale curriculum supplement focusing on wildlife concepts and integrated with many areas of the general school curriculum. It features decision making processes, and explores a diversity of attitudes towards wildlife.

The goal of project WILD is to prepare young people to make decisions affecting people, wildlife and their shared home, earth. In the face of pressures of all kinds which affect the quality and sustainability of life on earth as we know it, project WILD addresses the need for human beings to develop as responsible members of ecosystems.

Special thanks to the following people who contributed to this activity and resource guide: Helga Burre, Alice Hibberd, Jane McCarry, Susan Rauchwerk, and Patti Steinman, for suggestions used in the activities; Karen Eldridge, Betty Graham, Ann Hecker, for final editing , design and layout; Helga Burre, Betsy Colburn,Tom French, Ellie Horwitz, Marion Larson, Chris Leahy, Laurie Martinelli, Susan Rauchwerk, for reviewing and editing the text; Beverly Maffei, for contributing to the background research and to the resource section.

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Original poem sources:

Indian proverb from *The Earth Speaks*, by Steve Van Matre, The Institute for the Earth Education, 1983.

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Species fact sheets from the Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife:

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Appendix E: Endangered Species Coloring Poster

Did you know...

The peregrine falcon is nesting in Massachusetts for the first time since 1955.
The bald eagle is nesting in the state for the first time since 1905.
The osprey has made such a strong recovery, it was removed from the state's rare species list.
The plymouth redbelly turtle's population has doubled since captive-reared turtles began to be released back into their natural habitat.

Programs of the Massachusetts Division of Fisheries and Wildlife have helped in the recovery of each of these species.

The Teacher: Where do you begin?

The term "endangered species" evokes images of animals in peril throughout the world: the black rhino, the African elephant, the giant panda. The students with whom we work have some knowledge of worldwide endangered species, but how many of them could name a Massachusetts species that is now endangered, or a species that once thrived in Massachusetts and is now extinct?

Encourage your students to learn about the plants and animals close to home. Begin by taking them out in your school yard, local park, or conservation area. Keep a journal of observations. Remember that you are a facilitator, not an expert. Set up a situation for the students to investigate and let them decide what questions need to be answered. Give them the tools, discuss how to collect data, and help them process the experience. Help them understand that the decisions concerning the environment are difficult to make and that the very nature of an environmental issue implies that there are at least two sides to the issue. Let students role play situations. Encourage them to analyze newspaper articles and legislation. They will be learning skills that will serve them well as citizens and voters.

About This Guide

This resource guide, although written for grades three through eight, can be adjusted to any grade level, and will give you background information and a selection of activities to help develop a unit on endangered species in Massachusetts. In addition, the activities are such that they can be applied to any region of the United States. The message and the concepts remain the same; only the specific plants and animals change.

The major concepts that are illustrated by the activities include:

- All living things are interconnected.
- Animals and plants have basic needs of food, water, shelter, and living space for reproduction.
- Animals and plants are particularly vulnerable to extinction if their habitat is destroyed; if they have specialized food or nesting requirements; if they are naturally rare; if they are very sensitive to changes; if they have small broods and long gestation periods.
- Some animals and plants that were on the brink of extinction have made a recovery.
- Human beings by their actions can make a difference.
- The diversity of plants and animals in Massachusetts as well as on the earth is essential to the quality of life for human beings.

Activity: The Big Picture

"We're all in this together." You've heard this phrase, but not until the astronauts returned from space with pictures of the planet earth did we really comprehend visually that we were indeed connected to other countries and to those peoples, plants, and animals that live there.

Objective:

Students reflect on the interconnectedness of the plants and animals on earth.

Procedure:

Read the following passage attributed to a leader of Native Americans with your class and then answer the related questions.

"You must teach your children that the ground beneath their feet is the ashes our grandfathers. So that they will respect the land, tell your children that the earth is rich with the lives of our kin. Teach your children what we have taught our children—that the earth is our mother. Whatever befalls the earth, befalls the sons of the earth. If men spit upon the ground, they spit upon themselves.

This we know. The earth does not belong to man; man belongs to the earth. This we know. All things are connected like the blood which unites one family. All things are connected.

Whatever befalls the earth befalls the sons of the earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself."

For discussion:

- Restate the main idea of the author's quotation in your own words.
- List or illustrate five ways that you are connected to the Earth.

Activity: Earth as an Apple

Objective:

To introduce or reinforce that resources of the planet such as cropland are finite.

Materials:

- One very large apple for the teacher as a demonstration (or an apple for each group of students)
- paper plate or paper towel
- paring knife

Note: the teacher should try this activity before doing it with class.

Procedure:

1. Cut an apple into four pieces from top to bottom. One piece represents land, and the other three pieces represent the three-quarters of the earth that are covered by ocean.

2. Of the three-quarters that represent the ocean, take one piece and cut it in half. This one-eighth of the earth's surface represents the productive zones of the oceans; the rest supports very little life.

3. Cut this one-eighth piece into four equal segments. Take one of these segments and cut off a very thin slice. This slice represents the photic zone, the top 300 feet of the oceans through which light can penetrate and support photosynthesis (the process by which green plants produce food and give off oxygen).

4. Next, take the quarter section that represents land. Cut this quarter piece into two sections. One of these represents all the land that is too dry, too wet, too hot, or too cold to provide food for large numbers of people. This land consists of mountains, river basins, deserts, and icebergs.

5. The other piece, one-eighth of the earth's surface, is the part of land where most people live. Cut this one-eighth piece into four equal segments. Set aside three of the segments. The one remaining piece represents the portion of habitable land on which we are able to grow food.

For discussion:

- What do you think about the way land is used?
- Are there things that you would change? Why?
- How are the ways that people use land conflict with wildlife use?
  Examples: elephants in Africa
  vernal pools in Massachusetts
- What can be done to prevent these conflicts?

The Stage is Set: Why Study Endangered Species in Massachusetts?

The federal Endangered Species act is up for reauthorization this year. Our goals are to focus attention on the importance of strengthening this legislation and to educate citizens about the plight of endangered species in our own backyards and across the country. We are losing our native wildlife at a rate more rapid than that of the cataclysmic extinctions that wiped out the dinosaurs. The causes are nearly all of our own making; reversing this sad trend is our responsibility.

In every region of our state, from the limestone cobbles in the Berkshires to the barrier beaches on our coastline, species and habitats are in peril. Many of our disappearing habitats support rare and endangered plants and animals.

In Massachusetts, at least 72 species of plants and animals have been wiped out in the last 150 years. These lost species include the mountain lion, Canada lynx, eastern gray wolf, five lined skink and perhaps the regal fritillary butterfly, last seen in 1991. More than 200 species are currently state-listed as endangered and threatened, and that list swells to over 400 when you add species "of special concern." Many of these species are on the edge of extinction nationally; others are being driven from Massachusetts due to habitat destruction and loss of open space, degradation of ecosystems such as coastal areas and wetlands, and pollution by toxic chemicals.

1993 STATE BOX SCORE

Massachusetts List of Endangered, Threatened and Special Concern Species

(as listed in 321 CMR 10.60, January 29, 1993)

Taxonomic Group	Endangered	Threatened	Special Concern	Listed Total	% of Native Species
MAMMALS (including 6 whales)	7 (7 Federal)	0	5	12	14%
BIRDS (breeding, not the Eskimo Curlew)	11 (4 Federal)	6 (1 Federal)	13	30	14%
REPTILES (including five sea turtles)	8 (4 Federal)	5 (2 Federal)	3	16	53%
AMPHIBIANS	0	2	4	6	29%
FISH (inland species only)	4 (1 Federal)	2	3	9	23%
INVERTEBRATE (non-marine only)	22 (2 Federal)	17 (2 Federal)	54	93	N/A
PLANTS (vascular)	115 (3 Federal)	81	54	250	14%
TOTALS	167 (21 Federal)	113 (5 Federal)	136	416	15%*

* Total percentage excludes invertebrates since even a rough number of native invertebrate species in the state is not known.
Federal: Species also listed by the U.S. Fish & Wildlife Service as Federally Endangered or Threatened as of January 1993.

1996 State Box Score

Massachusetts List of Endangered, Threatened, and Special Concern Species

(as listed in 321 CMR 10.60, November 1995)

Taxonomic Group	Endangered	Threatened	Special Concern	Listed Total	Total Native Species	% of Native Species
MAMMALS (including 6 whales)	7 (7 Federal)	0	5	12	91	13%
BIRDS (breeding, exc. the Eskimo Curlew)	14 (3 Federal)	6 (2 Federal)	11	31	209*	15%
REPTILES (including 5 sea turtles)	8 (4 Federal)	5 (2 Federal)	3	16	30	53%
AMPHIBIANS	0	2	4	6	21	29%
FISH (inland species only)	4 (1 Federal)	2	3	9	39	23%
INVERTEBRATES (non-marine only)	24 (2 Federal)	17 (2 Federal)	58	99	**	**
PLANTS (vascular)	119 (2 Federal)	80 (1 Federal)	55	254	1,650	15%
TOTALS	176 (19 Federal)	112 (7 Federal)	139	427 (26 Federal)	2,040	16%

* Includes only native bird species known to nest in Massachusetts. Does not include migrants.

** The number of native invertebrate species is not known; they are therefore excluded from totals and percentages.

Federal: Species also listed by the U.S. Fish & Wildlife Service as Federally Endangered or Threatened as of Jan. 1996.

In November, the Massachusets Division of Fisheries and Wildlife added eight species to the Massachusetts List of Endangered, Threatened, and Special Concern Species. We have also made seven status changes of which six were to a more critical status.

VERTEBRATES

Two grassland bird species, Vesper Sparrow and Grasshopper Sparrow, were listed as Threatened due to habitat loss and fragmentation. Vesper Sparrow (*Pooecetes gramineus*) numbers have shown a decline in the past 100 years, with fewer than 100 pairs currently nesting in Mass.. The status of the Grasshopper Sparrow (*Ammodramus savannarum*) was changed from "SC" to "T." The population numbers are small and continue to decline. During the most recent inventory, only 300 territorial males were observed at 23 sites. Both the Grasshopper and Vesper Sparrows are regionally threatened in New England and have declining numbers throughout most of their North American range.

The Pied-billed Grebe (*Podilymbus podiceps*), Least Bittern (*Ixobrychus exilus*) and American Bittern (*Botaurus lentiginosus*), all previously listed, had their status changed to "E."

INVERTEBRATES

Six of the eight newly listed species are invertebrates. The Triangle Floater (*Alasmidonta undulata*) and Squawfoot (*Strophitus undulatus*) are two mussels that are now listed as "SC." Both species, historically common in New England, are now facing rangewide decline. Their habitats include ponds, lakes, and moving water with a clean, sandy substrate. Their decline is due to habitat loss and deteriorating reproductive biology. Agassiz's Clam Shrimp (*Eulimnadia agassizii*), a crustacean endemic to the region, is being listed as "E." There are one known current site and two historical sites, all occurring in Massachusetts. Agassiz's Clam Shrimp is found in ephemeral pools that are typically wet during early or late summer.

Other invertebrate species that were added or had their status changed are the following lepidopteran species:

Pine Barrens Lycia (*Lycia ypsilon*) - "T."
Unexpected Cycnia (*Cycnia inopinatus*) and Spiny Oakworm (*Anisota stigma*) - "SC."
Barrens Metarranthis (*Metarranthis apiciaria*) status changed from "SC" to "E."
Blueberry Sallow (*Apharetra purpurea*) - status changed from "T" to "SC."

PLANTS

New England Blazing Star (*Liatris scariosa* var. *novae-angliae*), a grassland species, was listed as "SC." Currently there are 35 known sites in 15 towns in Massachusetts. Most populations are small (less than 200 plants). Historically it is known to have occurred in 62 towns in the state. It is considered a candidate for possible listing under the federal Endangered Species Act.

Tiny Cow-lily's (*Nuphar lutea* ssp. *pumila*) status has changed from "T" to "E." Only one extant record is known from the state. Historically this species was more widespread occurring in 12-13 towns. This species occurs in rivers, ponds, and lakes and is vulnerable to many of the same threats as are wetlands.

- Vicky Frey-

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Why Be Concerned About the Loss of Wildlife Species?

Ecological Stability

Even the smallest species represents an important and irreplaceable link in the complex ecosystem that includes humans, animals, and plants. Each species plays an interdependent role in the dynamic functioning of a healthy and stable environment. When a species becomes extinct, its contribution to a healthy ecosystem is lost forever, and this may trigger the extinction of species that depended upon it.

Medical Research

Each species stores a wealth of genetic information which has taken millions of years to develop and perfect. Throughout history, scientists have found that the unique characteristics and chemical structures of some species possess incredible benefits to humans. Substances derived from plants and animals are found in at least 25 percent of all prescriptions written in the U.S. We have investigated only a small fraction of the world's species. If a species becomes extinct without having been researched, with it may go undisclosed medical cures that will never again be available to humans.

Agricultural Research

The world's plant species represent a virtually untapped source of potential agricultural benefits. Human populations worldwide depend upon plants to provide them with grains, fruits, and vegetables. Plant species that possess the ability to grow in varied climates, produce higher yields, and naturally resist pests and diseases may become extinct before we have a chance to uncover their secrets and incorporate their desirable characteristics into our domestic agricultural plants.

Economic Benefits

Economic benefits from recreation associated with watching, photographing, and hunting wildlife amounts to approximately $5 billion per year. By protecting endangered and threatened species, we preserve habitats that support and sustain other populations of wildlife. The monies generated through wildlife recreation help support a variety of industries: outdoor recreational equipment, travel, food and beverage, chemical, and automotive.

From: EPA fact sheet on Endangered Species, U S EPA Office of Pesticides and Toxic Substances, Office of Pesticide Programs, (H7501C),Washington, DC 20460

Activity: A story of Biological Conservation

Objective:

To increase students' appreciation of the role of wildlife in shaping Massachusetts culture and history.

Materials:

History of the Migratory Bird Act and the Beginnings of the Massachusetts Audubon Society

Procedure:

1. Have students read, or read to them, the following story.

2. Discuss the following questions:
   - •Which animals were Minna Hall and Harriet Hemenway trying to protect?
   - •What laws were passed as a result of their efforts?
   - •What did they do to educate people?
   - •Why did they choose "Audubon" as the name for their society?
   - •Ask students to look in the library for pictures of 1900's finery. Does it look elegant by today's standards?

"Aigrettes"and Audubon

In 1896, women in Boston wore ankle-length skirts, blouses with big puffy sleeves, and a hat whenever they went outside. The hats were wide-brimmed and often decorated with bird feathers, even whole bird wings and tails. One of the popular feathers was an "aigrette" plume. This long feather, from the snowy egret, was white and elegantly curved, making for a dramatic hat.

Snowy egrets are two-foot tall white birds with long legs, a long neck, and a long pointed beak. With the egret's long black legs and yellow feet, people often say that they wear "golden slippers." Snowy egrets nest in big colonies, making nests of twigs in areas with small trees or tall bushes. To attract mates during courtship, the adults grow special feathers—the long feathery aigrettes.

Plume hunters could make a lot of money by going into the egret colonies during the nesting season and killing the adults as they sat on their nests. The colonies were thus being destroyed because the baby egrets would starve in the nests after their parents were killed.

Harriet Lawrence Hemenway and her friend Minna Hall learned that snowy egrets in the Florida Everglades were being exterminated because of the demand for aigrettes. Instead of ignoring the problem, or simply saying, "Isn't that just awful!" they got together one

afternoon in 1896 and devised a plan. Harriet and Minna realized that if they could make the wearing of aigrettes unfashionable and socially unacceptable, the price of egret feathers would fall and the plume hunters would have no reason to continue killing the birds. They went through the Boston Blue Book, a list of the wealthy and important people in town, to look for the names of "ladies of fashion" who might wear aigrettes on their hats or in their hair. Harriet and Minna sent out letters asking women to join their cause. To join their organization, women would promise not to buy or wear aigrettes. Many Boston women did join the group, although others preferred to continue wearing the feathers.

The women needed a name for their group, so they decided to call it the Massachusetts Audubon Society, named for the famous painter of birds, John James Audubon. By 1898, the Boston group had over two thousand members, and fifteen other cities also formed their own Audubon societies. All these groups and many more people around the country pressured the federal government because state laws for protecting wildlife were weak or poorly enforced.

In 1883, George B. Grinnell, editor of the enterprising *Forest and Stream*, had helped to organize the American Ornithologists' Union, which vigorously opposed the millinery trade and drafted a model bird protection law later adopted by many states. In 1887, Theodore Roosevelt encouraged leading sportsmen to form the Boone and Crockett Club, which successfully lobbied for improved game laws, the creation of wildlife refuges, and the protection of Yellowstone Park. In 1898, Thomas Shields, editor of *Recreation* magazine, formed the League of American Sportsmen, the objectives of which were to "...protect game and game-fish, the song, insectivorous and other interesting birds not classed as game birds." Shields and Grinnell were close friends of Congressman John F. Lacey, who successfully sponsored the Lacey Game and Wild Birds Preservation and Disposition Act of 1900, which regulated interstate shipment of wild birds and mammals and the importation of exotic injurious wildlife. Thanks to the efforts of the Audubon Societies, Congress passed the Lacey Act, which made it illegal to transport to another state, birds killed in violation of a state's law and authorized the Secretary of Agriculture to work for the "preservation ... and restoration of game birds and other wild birds." Despite the new law, plume hunters pursued their attacks on the nesting colonies. In 1902, the National Committee of Audubon Societies raised enough money to send four wardens to Florida to guard the few remaining egrets at their nesting rookeries and also to watch over the colonies of roseate spoonbills whose pink feathers were used to make fans.

The following year, President Theodore Roosevelt established the first national bird reservation, Pelican Island, to protect the egrets. More reservations were established later. The wardens for the

reservations were paid by the National Committee of Audubon Societies. In 1905, one of the wardens, Guy Bradley, was shot dead by a plume hunter. Many people were enraged, and in 1906 a federal law was passed making it illegal to kill or disturb birds on reserved breeding grounds. This represented the beginning of a tradition of sportsmen's concern for protection of birds, especially migratory birds. A unique coalition of sportsmen and society ladies was formed.

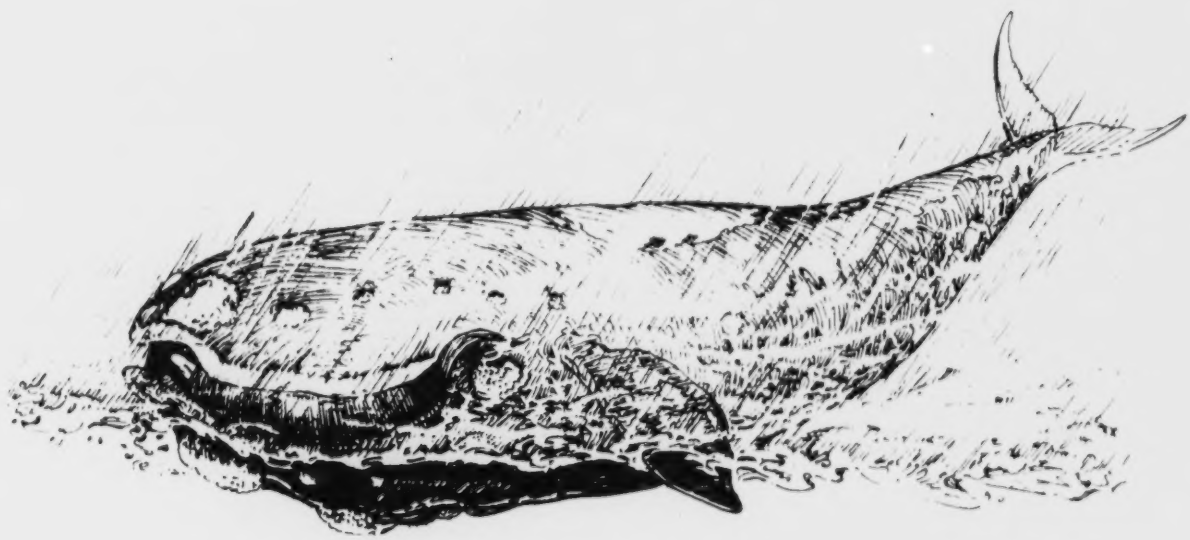
By 1918, the Migratory Bird Treaty Act was signed and the U.S. Government had taken over federal responsibility for egrets and all migratory birds. Through a treaty with Canada, England, and Mexico, birds are protected by very strict laws.

Snowy Egrets are no longer at risk because they live and nest mainly in Florida and southern coasts, and are not common in Massachusetts. However, you might see one in a marsh or a pond in eastern Massachusetts, standing in the water and using its "golden slippers" to stir up small fish to catch with its long bill. You can see these birds today, because Minna Hall and Harriet Hemenway cared about them almost 100 years ago.

Roseate Tern

Where Does Wildlife Fit in My Life?

Many conservation agencies and organizations receive thousands of phone calls a year from people with questions about wildlife. ("There's a raccoon in my backyard; is it rabid?" "Why is this bird flying into my window?" "Is it true ... is there a moose in Natick?" "I found a baby bird; will you take it?") An interaction with wildlife is almost a daily occurrence for people. This interaction can be positive or negative. As educators, we can help our students understand the role plants and animals play in our lives. Yes, even those green head flies at the coast in July have a role to play in the food chain! Respect for all of life is a concept not just taught but modeled by our behavior and attitudes. We begin with awareness. The following activities help students become aware of the presence of wildlife, plants, and animals, in their everyday lives.



Right Whale

Activity: Wildlife in My Neighborhood

Objective:

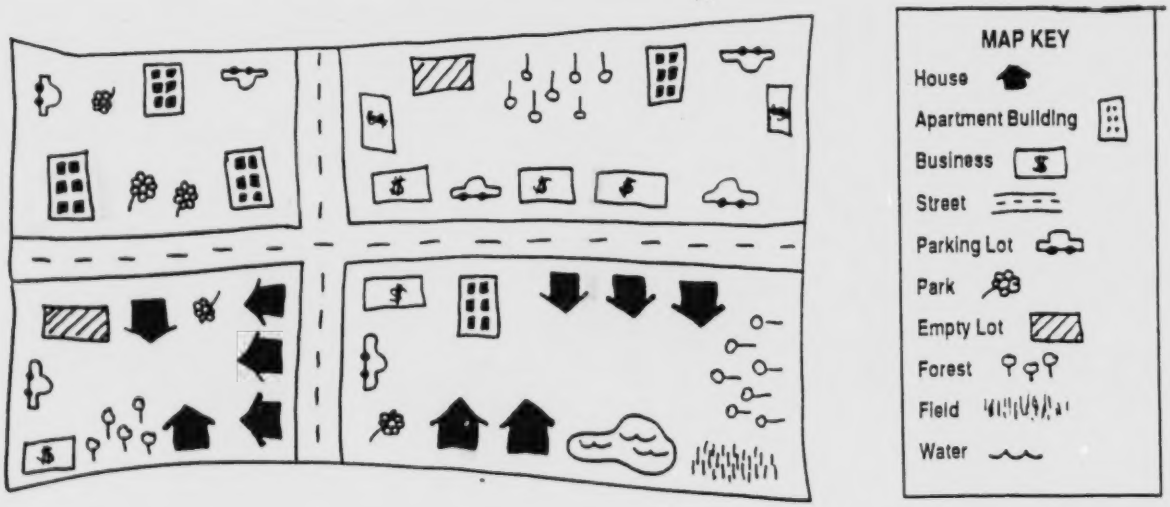
To increase students' awareness of the presence of wildlife on their way to and from school.

Procedure:

1. Explain to your students that for one week you want them to record any wildlife (plants and animals) that they observe on their way to and from school.

2. Begin by having each student reconstruct on a large piece of paper their route to and from school each day. Have each student draw in the obvious landmarks, trees, rocks, stores, and houses. Because this first mapping experience is from memory, have them check it out with reality.

3. As a class, create a key of symbols that everyone will use, indicating trees, shrubs, and special features. Fill in the maps with the appropriate symbols.



Source: Friends of the Earth, 2003 D South East Street, Washington, DC

4. Ask your students to record directly on their base map any animals or evidence of animals that they observe while traveling back and forth to school. (Plants can be shown using the symbols.)

5. Ask them to make daily entries in a separate journal and record what the animals were doing, e.g., running, eating, singing, and if they actually saw the animal or heard it.

6. At the end of five days, ask your students to draw some conclusions about what they saw and heard. Did some areas along the route have more animal activity than others? How do you account for that? Does there appear to be any relationship between where animals are found and where plants are found?

Follow-up:

- Write a story about something you observed.
- Describe a plant/plant interaction; a plant/animal interaction; an animal/animal interaction.
- Construct a food chain or web for your neighborhood.
- Choose an animal or plant to research.
- Exchange maps and walk or ride the route of another student.
- Create a school display of the maps.

Variation:
Mapping the Schoolground

Obtain or make a map of the schoolground. Divide it into four quadrants. With your students, agree upon and create a symbol key to indicate landmarks and plants. Divide the class into four groups and give each group a quadrant to investigate and to fill in with the details of the schoolground habitat. Tape all of the quadrants back together. Have the students return in their groups to their area to locate animal evidence. Create a classroom display and add data to the map throughout the year, noting seasonal changes. Have the students add plants and animals to their map throughout the year. Are there more or fewer animals? What changes occur? record all of your observations in a journal. Sketch the changes.

(Adapted with permission from Project WILD, © 1983, 1985, Western Regional Environmental Education Council, *Wildlife is Everywhere.)*

Did you know...

The piping plover's population has doubled in the state since 1990, when portions of beaches were closed to vehicles to prevent them from running over the hard-to-see chicks.

Activity: Food for Thought

Objective:

To identify which foods are derived from plants and animals and to trace some foods from their source to the consumer.

Procedure:

1. Select a processed food item. Identify the item's ingredients. In discussion with the students, trace the ingredients back to their origins. Which ones are derived from plants and which from animals? Include where and how they grew or were formed and how they were harvested, processed, transported, packaged and made available to the consumer.

2. Ask the students to generate a list of foods that they ate the day before for breakfast, lunch, dinner, and snacks. Which ones are derived from plant and animal sources? Next to each item place a P for plant or A for animal depending upon their derivation.

3. Ask each student to pick one food to trace back to its origins, including where and how it grew, was harvested, was processed (if it was!), was transported, was packaged and was made available to the consumer - the student. Ask the students to make simple flow diagrams of the path the food takes. How might this have affected wildlife? (The students may want to do some research at this point to get some additional information.)

4. Ask the students to report back to their classmates, using their diagrams as visual aids as they describe the path taken by their food.

Follow-up:

Create a food chain based on what you ate for lunch. How many students ate foods that came from long distances and from other countries?

(Adapted with permission from Project WILD, © 1983, 1985, Western Regional Environmental Education Council, *Lobster in Your Lunchbox* and *What Did Your Lunch Cost Wildlife?)*

Ecosystem, Habitat, Niche—a Definition of Terms

These three terms and the concepts that they represent are important to the study of endangered species. An ecosystem can be viewed as a set of living and nonliving elements, interacting over time within a defined locale. At a global level, all of the elements on the planet interact. For practical purposes, we will use ecosystem when referring to groups of organisms interacting as a community. Within these biological "neighborhoods," it is possible to assign organisms both an "address," describing their typical location, and an "occupation," or role that they play in the system. An organism's address is its "habitat." The occupation of an organism in an ecosystem is called its "niche."

In a typical pond ecosystem, there are many zones or biological neighborhoods: the benthic zone with bottom sediments, the littoral zone or edge, the surface film, and the open water zone with its floater, swimmer and drifter organisms. Each zone or habitat within the aquatic ecosystem of the pond has plants and animals that have specific roles or activities—niches within the system.

In order to understand the diversity of life forms, we need to investigate all of the addresses. We study ecosystems to help students understand the interactions and to show them that a living system is a complex mosaic in which all the parts fit together and make a whole. The removal of one small apparently unimportant component can often have major consequences.

(Adapted with permission from Project WILD, © 1983, 1985, Western Regional Environmental Education Council, *A Guide to the Ecosystem Concept.*)

Did you know...

The upland sandpiper is a migrant bird which depends on temperate habitats for its survival and is at risk from habitat destruction in North and South America. Because of shrinking grassland habitats, this bird has been mostly confined to airports in Massachusetts. In Argentina, the species' wintering grounds are being changed as hay fields are being converted into mono-culture cropland.

What's in a Word?

The word list provided can be used in a number of ways to increase students' vocabulary and their understanding of some of the terms used in describing wildlife, endangered species, and their habitats within ecosystems.

Endangered Species Word List

adapted, adaptation	The process of making adjustments to the environment
biodiversity	the variety of life and living systems on earth
carnivore	an animal or plant that eats animals for food
community	an association of interacting organisms sharing resources
conservation	the use of natural resources in a way that assures their continuing availability to future generations
diurnal	refers to an animal that is active mainly in the daytime
ecosystem	a set of elements, living and nonliving, interacting over time, within a defined locale
endangered	any species of plant or animal that is in danger of extinction
environment	all of the conditions surrounding a living thing which affect its growth and behavior
extinction	the condition of having been removed from existence. An animal or plant facing extinction is one in danger of vanishing from our world.
extirpated	status of a species that once lived in an area but is no longer found there; its absence is usually due to human interference
forest	an area where trees are the most common plants
grassland	a habitat where most of the plants are grasses
habitat	the place where a plant or animal naturally lives and grows and where it obtains food, water, shelter, and space
herbicides	chemicals used to kill plants—"weed killers"

herbivore	an animal that eats only plants
niche	an organism's "occupation" within an ecosystem
nocturnal	active by night; the opposite of diurnal
omnivore	an animal that eats both plants and animals for food
pesticides	chemicals used to kill plants and animals which might harm food crops, domestic animals or other resources important to people
prey	an animal that is hunted and killed by another plant or animal
rare	referring to wildlife species not presently in danger but of concern because of low numbers
secure	in wildlife terms, a species whose population is steady or even increasing
scavenger	an animal that feeds upon dead animals, plants, or waste materials
special concern	a legal term to describe a species which has been documented to be suffering a decline or is in such small numbers that it could become threatened
species	a population of organisms that are more or less alike and that are able to breed and produce fertile offspring under natural conditions
threatened	a legal term to describe a species present in its range but in danger because of a decline in numbers
vernal pool	a temporary, spring breeding pools for amphibians, aquatic insects, crustaceans

Activity: Wildlife Words I

Objective:

To increase students' vocabulary and increase their understanding of words and phrases as applied to the study of endangered species.

Procedure:

1. Ask the students to think about the phrase "endangered species."

2. Using the chalkboard or a large sheet of paper, have the students brainstorm at least one hundred words relating to the phrase "endangered species." Help them by suggesting concepts that are related, e.g., habitat, pesticides, food chain.

3. Place the slips of paper in a bag/box and shake to mix them well.

4. Arrange the students in groups of four or five, and have one member from each group select one slip of paper.

5. The whole group then acts out silently the word or phrase for the other students to guess.

6. Play the game until each group has acted out at least three words.

(Adapted from: Project Wild, © 1983, 1985 Western Regional Environmental Education Council, *Visual Vocabulary*.)

Sandplain Gerardia

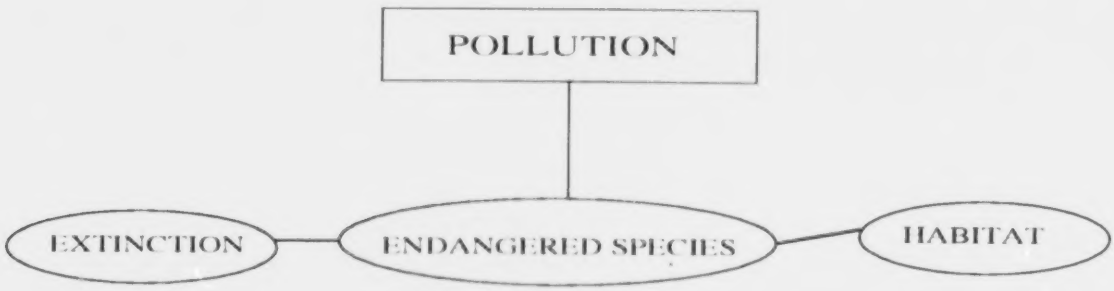
Activity: Wildlife Words II

Objective:

To increase students' vocabulary and to have them make associations with words having to do with endangered species.

Procedure:

1. Using the list of words that were recorded in the previous activity, ask the students to create word trees of endangered species related words. Begin with a word tree like the one below.



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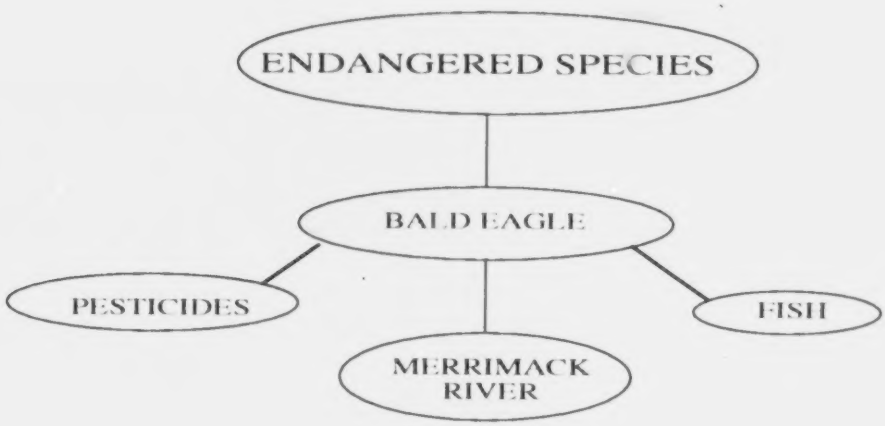


2. When students have finished several word trees, have them create sentences or paragraphs about endangered species.

(Adapted with permission from Project WILD, ©1983, 1985, Western Regional Environmental Education Council, *Aqua Words*).

Threats to Wildlife in Massachusetts

The three major causes of endangerment for plants and animals in Massachusetts are habitat destruction and degradation, pollution by toxic chemicals, and introduction of exotic species and overharvest.

Habitat Destruction

Loss of habitat is the most critical threat to wildlife because it permanently impacts whole natural communities and ecosystems containing many species. Land lost to development is habitat lost forever. In the 300 years from colonial times until 1970, Massachusetts developed land equal to a total area slightly smaller than the state of Rhode Island (776,000 acres). In the next fifteen years, we developed more than 40 percent as much land as in our entire previous history. Based on our projections, by 2010, the amount of developed land will have doubled since 1920 to an area twice the size of Rhode Island. And by 2030, assuming land consumption trends continue, an area nearly three times the size of the state of Rhode Island or 40 percent of all Massachusetts land, will be developed.

Several regions of the state with particularly diverse and unusual natural communities and the greatest variety and frequency of rare, endangered, and threatened species are also experiencing the most intense development pressure. These include Cape Cod, Nantucket, Martha's Vineyard, and parts of Bristol and Plymouth counties, as well as the Berkshires and the Connecticut River valley.

With the spread of development and increased population come increased disturbance and degradation of the remaining natural communities. Examples include the following:

- Eutrophication of ponds and lakes due to increased pollutants in storm water runoff and improperly installed and maintained septic systems.
- Increased predation by house pets on ground-nesting birds, small mammals, reptiles, and amphibians.
- Disruption of migratory routes of terrestrial organisms such as salamanders.
- Alteration and pollution of ground and surface water supplies.
- An increase in sewage that may pollute wetlands and clam flats.
- The proliferation of certain species which coexist well with humans, e.g., gulls, raccoons and skunks, which become pests.
- An increase in temperature fluctuations due to removal of trees and covering of ground with pavement.
- An increase of toxic chemicals in the soil, air, and groundwater from lawn care chemicals and fertilizers, mosquito spray, illegal dumping, industrial accidents, and automobile exhaust.
- Damage to habitat and wildlife by excessive use of natural recreational areas.

Pollution by Toxic Chemicals

Natural communities are exposed to toxic pollutants generated as byproducts of many human activities, including energy generation and transportation, waste management, industrial processes, and the use of consumer products. Significant

toxic exposures also originate with the use of pesticides, chemicals that are designed to be toxic and are introduced intentionally into the environment. Pollutants may be present in the air, precipitation, soils, sediments, water, vegetation or other organisms. Some are short-lived, decomposing rapidly in the environment, and other, like metals and some synthetic organic compounds, are highly persistent in environmental media, especially soils and sediments.

The effects of exposure to toxic pollutants are characterized in several ways. Effects may be acute, resulting from a single or short term exposure, or may be chronic responses emerging only after repeated or continuous exposure. Effects may be immediate or delayed, permanent or reversible. therefore, toxics may cause not only immediate deaths, bu: neurological and behavioral effects, reproductive impacts, latent illnesses such as cancer, immune system impairments, and birth defects and developmental failures—effects that ultimately lead to declines in populations.

Other Threats to Wildlife in Massachusetts

•**Prejudicial, indiscriminate, and accidental killing** - This includes backyard bug zappers, road kills, aerial obstacles such as radio towers, and entanglements. Marine mammals, reptiles, and birds often become entangled in fishing gear, disabling them, often fatally. Snakes, bats and spiders are often killed on purpose by people who are afraid of them.

•**Ecological imbalance** - Examples include the enormous increase in gulls in the last fifty years due to the increase in both open landfill dumps and wastes from the fishing industry and the local overpopulation of white-tailed deer due to the removal of natural predators.

•**Alien species** - Species brought in from elsewhere, for instance, European buckthorn and purple loosestrife, now abundant in wetlands throughout the state have replaced native plant species. European starlings and house sparrows compete with native cavity nesting birds such as eastern bluebirds and tree swallows. The introduction of the Gypsy moth is another example.

•**Release of unwanted domestic animals** - Unrestrained pets, cats, and dogs contribute to the decline of songbirds and other wildlife.

•**Absence of habitat management** - Before settlement, the biological communities of Massachusetts were maintained as a naturally diverse ecological mosaic by natural events. In a small, densely populated state such as Massachusetts, we can no longer depend on nature to manage randomly. Because many community types, e.g., grasslands, heath lands, and certain wetlands, will "succeed" into different communities, there needs to be planned management. If we are to retain the species that depend on these communities, this management might include selective burning or cutting, or grazing.

•**Recreational harvest** - Game laws are designed to prevent over-exploitation, but when other factors change, such as weather at breeding time or a poor nut crop, recreational taking of species can be a factor in reducing populations; e.g., black duck and striped bass both have suffered reduced populations for which responsible harvest limits have been set and need to be strictly enforced. Several species of

orchids and native Massachusetts wildflowers have also suffered from the illegal casual picking and transplanting to gardens.

• **Destruction of neotropical wintering grounds** - Sixty-five percent of all the songbird species that nest in Massachusetts winter in tropical habitats of Mexico, Central America, and the Caribbean Basin. Habitat destruction in these areas affects our bird populations.

Did you know...

Exotic species, those that have been introduced to this region either accidentally or purposely, pose many threats to native and sometimes endangered flora. In the Berkshires, phragmites threatens the unique vegetation in a Stockbridge bog. Buckthorn is encroaching on a Berkshire wet meadow which is home to several rare species. On Nantucket, Japanese black pine and black locust are creeping onto the rare coastal heathland habitat.

Activity: Wanted: Wild and Rare

Objective:

To examine the life histories of animals or plants that are endangered, threatened, or of special concern in Massachusetts and be able to identify the causes that make them vulnerable to extinction.

Procedure:

1. In the appendix, you will find a sampling of species' biographies.

2. Read through to find one that interests you. Can you determine in each case the main reason or reasons that this animal or plant is on the state endangered, threatened, or special concern list? Are any of these species also on the federal list?

3. Create a "Wanted" poster on your species. What type of campaign could help to restore this species to the safe category? Try to include the following information.

- species common name
- where it is seen; its range
- population status
- place where it was last seen
- picture or drawing of the species
- any special characteristics or features
- food source
- habitat needs
- predator-prey relationships
- restoration or safety plan

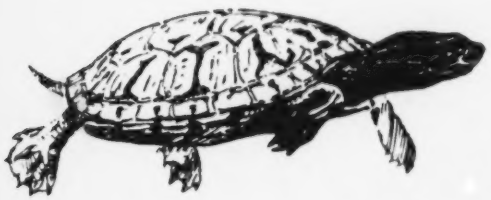
4. After researching their species, allow students to interview each other. (Where does your animal live? What does it eat? Why is it endangered?)

Follow-up:

- Make a classroom set of posters or cards "Wanted: Wild and Rare" and use as flash cards. Flash cards are great learning tools, and students can often use them independently. Various games can be played. **Memory** involves looking at the cards then turning them over or removing them and trying to recall the facts about the species. **Flash Recall** is recalling the name by looking at the picture. **Categories** is putting all the cards face up on a table and picking all the ones that fly ... lay eggs ... have fur ... are the same size ... are mammals ... are herbivores. **Charades** requires each person to choose a card, keep it secret, and act out the animal to see if others can guess. **Wild Stories** requires students to pick four cards and create stories using all four species.

•Take a walk around your schoolground. Could each student's species live on the playground? What is missing? Design new schoolgrounds as habitats for each student's species. You could draw maps of the "new" schoolgrounds.

(Source of the follow-up activity: Hitchcock Center.)



Plymouth Red-bellied Turtle

Activity: Death of a Firebird

Objective:

To help students understand how habitat loss contributes to extinction of a species in Massachusetts.

Materials:

- "Death of a Firebird"

Procedure:

1. Have students read the story "Death of a Firebird" or read it to them, then answer the following questions.
   - What do you think caused the heath hen to become extinct?
   - Could extinction of the heath hen have been prevented?

Death of a Firebird

It is an eerie feeling to be one of the few living people who still remembers a bird now long extinct. My memories of the heath hen are personal and not entirely pleasant.

It was when I was a small child that I paid one of my many visits to Martha's Vineyard Island to stay with my friend Dorothea. Her mother, somewhat anxiously, asked, "Do you know how to ride?" My answer was a simple "yes." If other children could stay on top of a horse, I had perfect confidence in my ability to do the same. So, I was given Echo, a tall mare with a bumpy trot and a splendid gallop, and I managed to stay on until a covey of heath hens exploded beneath Echo's feet. She danced sidewise, reared, and dumped me on the ground—sandy ground covered with a mat of tiny oak trees.

Somewhat bruised and mightily humiliated, I climbed onto Echo and asked, "Which way did they go?"

"They?"

"Those birds!"

At this point, Dorothea and I had a major misunderstanding. Knowing of my intense interest in birds, she assumed that I wanted to see more of those creatures. My wish, however, was to *avoid* them and stay on my horse, but much of the remainder of the visit was spent looking for heath hens.

These birds never seemed to go down to the beach where we could gallop free and uninterrupted. They were never along the deep woodland trails either. I remember where Dorothea and I found the heath hens; they abounded in the shinnery and grassy spots within it. Shinnery is a scrub oak forest growing only shin high as though to be invaded by elves and goblins. It is a product of fire: little oaks, burned again and again, cannot grow tall. I didn't understand then that the heath hen was absolutely dependent on fire.

It is said that the Great Plain on Martha's Vineyard had been burned by Indians since time immemorial. Early settlers set fires to improve sheep pasture and to keep the blueberry and huckleberry crops coming in well. Fire was the key to

keeping the Great Plain open. But in those days, fires had come to be considered the archenemy of wildlife.

When I knew the heath hen in 1920, the shinnery in places was getting to be knee high, and grouse expert Alfred O. Gross estimated that there were 500 birds left. It seemed to me many more than that because Echo continued to throw me, and during the swimming hour my cuts and bruises stung like fury in the salty water. The heath hens used to flush beneath Echo's feet, bursting out with a startling roar of wings—to fly away across the open plain. It was plain that they felt safer from enemies out in the open where they could get away.

Dr. Gross made an intensive and dedicated study of these dwindling birds and in 1928 he published his comprehensive book, *The Heath Hen*. He said that in May 1906, the number of this species alive in the whole world did not exceed 80. There was an extraordinary increase to about 2,000 birds in 1915 to 1916, followed by a nasty drop to under 200. After another high when the population zoomed to the comparative safety of over 500 individuals in 1920, it declined again, and never recovered.

When the heath hen got scarce, there was much concern, but some of the local people said, "The birds can look after themselves. They've always been here, and they always will be." The people who lived there didn't see how the country was gradually changing. Some blamed the scarcity of the birds on the owls and rats, and some blamed the summer people who went back to the city in fall and didn't catch their cats and take them home with them; these cats were said to be of enormous size. Endless warfare was waged on these "vermin." During one year, 15 marsh hawks, 3 sharp-shinned hawks, 5 red-tailed hawks, 23 cats, and 118 rats were killed.

These measures were not particularly helpful, for the doom of the heath hen had already been sealed. Dr. Gross had written: "The year 1907 witnessed one of the most notable steps taken to preserve the species from extinction ... the establishment of a reservation for the purpose of making fire stops." Ironically, the major attempt to save this race was the suppression of fire! In my later visits to Martha's Vineyard, in my teens, I used to drive across the Great Plain. It was no longer a plain; it was a young forest.

In 1932 the heath hen was declared extinct.

Years later I had the pleasure of meeting Dr. Gross. With the brashness of youth, I declared, "My degree is in game management, and I'd like to ask you some questions. It wasn't disease, or sterility, or cats left by summer people that killed off the heath hen, was it? It was fire suppression, wasn't it? It turned that plain into a forest where no open country bird could live, didn't it?"

Dr. Gross, who had spent so many years of his life trying to save an endangered bird, answered very softly, "We didn't know it then."

(adapted from "Death Of A Firebird" by Frances Hamerstrom. Her new book will appear in 1994: *My Double Life: Memoirs of a Naturalist*).

Note: The heath hen was present on the mainland of Massachusetts until 1869. Originally, possibly because of regular firs set by the local Indians, many woodlands in New England were very open. In 1630, Reverend Higginson spoke of a hill near Boston from which one could see "thousands of acres [with] not a tree in the same." Boston itself was nearly bare of trees, an ideal heath hen habitat, and colonists were forced to seek wood from nearby islands.

Did you know...

Burning is an ecological management practice that can help save endangered species and habitats. Burning takes place in several areas of the state. Nantucket's coastal grasslands, home to short-eared owls and Northern Harriers and former home of the now-extirpated Regal Fritillary butterfly (last seen in 1990) are periodically burned in order to maintain the habitat threatened by encroaching nonnative vegetation.

The Bald Eagle in Massachusetts

The facts on endangered species aren't all bad. Much effort and hard work by many people have saved a number species from extinction. The bald eagle, for example, a well-known species found throughout Massachusetts and the United States, has made a strong comeback. The U S government has banned in our country the use of DDT, a harmful pesticide, which caused the female eagle to lay eggs that had very thin eggshells, thus causing them to break and not hatch. With such a law and the public's support of such a majestic bird, the bald eagle is increasing its numbers. Massachusetts has also restored the eagle to our state by breeding them and releasing them; here is its story.

The Bald Eagle Nests in Massachusetts Once Again!

Before the 1989 eagle nesting in Massachusetts, the last pair of eagles were thought to have nested in around 1905. The effort that brought the eagle back after almost 80 years happened at Quabbin Reservoir.

Quabbin Reservoir is a large, man-made lake that was created when a dam was built on the Swift River in 1939. Over the years it developed a large population of fish and began to attract many different wildlife species which viewed the reservoir as good habitat. Among these new species were bald eagles, which began to come from other breeding areas to spend the winter at Quabbin. When efforts began across the country to help restore bald eagles, Quabbin seemed like a good place to release young birds. In order for this project to work, it took the cooperative efforts of the state's Division of Fisheries and Wildlife, the Massachusetts Audubon Society, the U S Fish and Wildlife Service and the Bank of Boston. This cooperation paid off.

Between 1982 and 1988, 41 nestling eagles from wild nests were brought from Manitoba, Nova Scotia, and Michigan to be raised and released at Quabbin Reservoir. The eagles were already imprinted to their species and it was hoped they would be imprinted to the Quabbin area as well. If this experiment worked, the mature Bald Eagles would return to Quabbin in about five years from their release date and they would nest.

In 1988, a small bunch of loosely piled sticks was spotted in a large oak tree on one of the islands of Quabbin. The following year a pair of eagles was observed working on a full scale eagle nest in the same location. One of the birds was "Ross," the first eagle to be raised at Quabbin in 1982. The other bird had been released in 1984. This pair was successful in fledging two young. That same year, another nest was discovered by nature enthusiast Ed Bennett at the southern end of the reservoir. The second pair fledged one young.

Since that first successful nesting year, 4 additional nests have been built at Quabbin, 2 nests on the Connecticut River, one nest on

Assawompsett Pond in Middleboro, and a nest on Barkhamsted Reservoir in the state of Connecticut. By 1993, 26 young eagles had been born in the wild as a result of this restoration effort.

The next step in this project will be the return of the Massachusetts-born eagles as they mature and search for nesting territory. This event first occurred in 1989. The continued return of the fledged young as adults will help ensure the future success of the species in Massachusetts.

Every year the Massachusetts Division of Fisheries and Wildlife (MDFW) coordinates a Midwinter Eagle Survey as part of the national count organized by the National Wildlife Federation. In 1982, a total of 16 eagles was counted across the state. Observers recorded 70 Bald Eagles on January 8, 1993. Of the 70, 50 were seen at Quabbin Reservoir with the balance being seen on the Connecticut, Merrimack, and Taunton Rivers, Assawompsett Pond, and Cape Cod.

Bill Davis, current Eagle Project Leader for Massachusetts, can be contacted at the MDFW in Westborough for more information. If you are interested in viewing the Bald Eagles at Quabbin Reservoir, contact the Visitor Center at 413-323-7221.

Activity: Bald Eagle Game

Objective:

To illustrate how pesticides infiltrate a food chain resulting in the poisoning of wildlife and to illustrate the concept of biomagnification in a food chain.

Materials:

- index cards
- yellow marker

Procedure:

1. Cut each index card into 5 - 7 short strips, providing enough for each student to have seven "fish."

2. Using a magic marker, draw a yellow dot on 1/3 to 1/2 of the "fish."

3. Hide the "fish" around the classroom.

4. Tell students to pretend to be bald eagles hungry for their staple fish diet. Students have to find as many "fish" as possible.

5. Once all the "fish" are found, have the students count the number of "fish" they found.

6. Ask each student who has one "fish" or none to pretend to die as a result of starvation; speculate on reasons—injury, illness, overfishing. Tell students who have 2 to 4 "fish" that they have caught enough fish to survive but not enough to raise a family; perhaps they are young eagles without enough practice catching fish, or the fish are scarce in their area. Students with 5 or more "fish" are obviously healthy eagles with excellent skills and living in a decent fishing area.

7. Have all living eagles sort their "fish" again and count only the ones with yellow dots.

8. Explain that the yellow dots represent DDT, a chemical that was sprayed on trees and farms in the 1950s and 1960s to kill insects. When it washed into streams, it was absorbed by tiny plants that were eaten by small animals, which were, in turn, eaten by fish. Any DDT in food gets stored in an animal's body instead of being eliminated. An eagle eating one fish gets all the DDT from the hundreds of small animals the fish ate. Each time an eagle eats another fish with DDT, the DDT accumulates in the eagle's body. It takes a lot of DDT to kill human, mammal or bird.

9. DDT accumulated in eagle bodies has a much more insidious effect. They may appear fine, but the DDT in their bodies has made their eggshells so thin that the eggs are smashed when the parents try to keep them warm. If more than half of your fish have a yellow dot, you are at risk and more than likely unable to raise young.

10. How many eagles are left to successfully raise their young?

Follow up:

Some animals and plants are more vulnerable to extinction than others. With your students, examine the life cycle and habitat requirements of a number of species that appear to be "secure." We've defined "secure" in wildlife terms as a plant or animal species whose population is steady or even increasing. What are the elements that make this species successful? Review how the animal or plant gets what it needs in terms of food, water, shelter, and space to reproduce.

(Adapted with permission from Project WILD, © 1983, 1985, Western Regional Environmental Education Council, *Deadly Links*.)

Activity: Extinction Proof

Objective:

To discover the reasons why some species seem to be "extinction proof" through the creation of an animal or plant that is "extinction proof." Also, to examine the life histories of what appear to be "secure" species.

Background:

Some animals and plants are more vulnerable to extinction than others. This activity examines the life cycle and habitat requirements of a number of species that appear to be "safe." We've defined "safe" as a plant or animal species whose population is steady or even increasing.

Procedure:

1. Discuss with your students animals and plants that they know that appear in great numbers and are flourishing, e.g., painted turtles, raccoons, crows, squirrels, dandelions.

- What are the elements that make these species so successful?
- How does each animal or plant get what it needs in terms of food, water, shelter, and space to reproduce? What habitat requirements does each have?
- In what ways do they differ from species that are endangered?

2. Review with your students the threat of extinction to various species as well as the habitats that support them. Have students choose a habitat. Have each student write a threat to extinction on a piece of paper.

3. Collect and redistribute these slips of paper with various threats to survival written on them.

4. Pairs of students pick at least two pieces of paper describing the threats to their species. They then design an animal or plant that is "extinction proof."

5. Each student or group of students presents their imaginary species. Classmates may ask questions of the presenters.

Follow up:

Research the history of some of the introduced species in Massachusetts, e.g., starlings, gypsy moths, purple loosestrife. Write the story of their success. Is their success a problem for our native species? In what way? Describe.

Activity: Schoolground Habitats

Objective:

To help students determine what a habitat is; to observe life in a defined area and to present your information about your habitat to the rest of the class.

Equipment:

Hula hoop, baggies, trowel, thermometer, data sheet for each group, large chart paper, markers.

Procedure:

1. Ask your students what they think a habitat is. What do plants and animals need in a habitat? List all of their ideas on a large piece of paper or on the board.

2. Is their classroom a habitat for them? In what way? Where do they get what they need? Water, food, personal space.

3. Just as their classroom is a micro-habitat, a small section of a larger habitat—the school, there are micro-habitats in the natural world that have their own climatic conditions, and specialized plants and animals.

4. Assign students to groups of four to five in a group. Give each group a hula hoop, thermometer, trowel, and baggies, and tell them that they are going to investigate a micro-habitat in their schoolground.

5. In a designated area, have students toss their hoop and ask them to gather and record data on the following (20-30 minutes).

- Evidence of plants. Which are predominant?
- Evidence of animals. What do they observe about their behavior?
- Are there human influences on this micro-habitat?
- What are the physical factors: temperature, sunlight, shade, humidity?
- What is the soil like?
- Note any other interesting features.

6. Upon returning to the classroom, give each group a sheet of chart paper and markers, glue, etc. Tell them that they have 20 to 25 minutes to work on a presentation to the rest of the class. Suggest that they can be creative with their presentation, i.e., draw a mural, write a poem, write and perform a rap, dramatize their micro-habitat.

For discussion:

- How are the micro-habitats the same or different?
- Do additional research on a plant or animal found in your micro-habitat.

Follow-up:

1. In the appendix you will find descriptions of fourteen natural communities in Massachusetts that are habitats for wildlife. These are communities that are threatened and are in danger of being lost forever. Each community supports very specific plants and animals.

2. Are any of these habitats familiar to your students? Do they occur in your part of the state?

3. Choose one to do some research on.

Note: Massachusetts Audubon has recently published a teacher curriculum guide on learning about and certifying vernal pools in Massachusetts. Call the Educational Resources Office at the Massachusetts Audubon Society at 617-259-9500, or write the Education Department, Massachusetts Audubon Society, South Great Road, Lincoln, MA 01773.

Did you know...

There is an effort underway to federally list the Timber Rattlesnake because of declining populations throughout its range. Increased logging, development and poaching all threaten the rattlesnake and its habitat. Recently, experts throughout New England compiled data on the range and number of timber rattlesnakes and discovered that the situation was worse than they had anticipated.

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Activity: Shrinking Habitat Game

Objective:

Students will appreciate the pressure for space that an animal species faces if its habitat shrinks or is lost. This is a simulation activity.

Background:

There are many factors contributing to habitat loss. Natural factors include climatic change, natural disturbances, and pollution. Human-induced factors include pollution, fragmentation of the space that animals or plants need to live, building, and development.

Established as a reservation by the Metropolitan District Commission in 1895, the Blue Hills Reservation is a 10-square mile area comprised of many habitats such as a hilltop habitat, a mixed deciduous forest habitat, a small hemlock forest habitat, a stream habitat, vernal pool habitats, a marsh habitat, and a quaking bog habitat. The area is basically rocky hills covered with oak and white pine. In 1895, the area was mainly farmland and scrubby undergrowth, but the forest has now grown back.

Materials:

- five hula hoops (one for each habitat)
- animal pictures and information

Procedure:

1. Begin by brainstorming reasons for habitat loss and recording these on the board.

2. Place the names of the following habitats on the board: hilltop, deciduous forest, vernal pool, roadside/edge, red maple swamp.

3. Ask the students to list any plants and animals that they know occur in those habitats. Is there any overlap?

4. Distribute 5 hula hoops either outside in the schoolyard or in the classroom and label and number each hoop as one of the five habitats. Example: 1 - Hilltop.

5. Have students choose an animal to be and make an identification card to be displayed prominently either pinned or taped on them. In addition to placing the name of the animal on the card, they should place on the card the number of the habitat in which this animal can find food, water, shelter and space.

Examples:

Habitats and their numbers:

1. Hilltop

2. Deciduous forest
3. Vernal pool
4. Roadside/edge
5. Red maple swamp

Animals and the corresponding number of the habitat that they can live in:
As an example: American toad can live in a deciduous forest (2), a vernal pool (3), a roadside (4) and a red-maple swamp (5).

robin - 2,4,5
garter snake - 2,4
slug - 2,4,5
wolf spider - 2,3,4,5
spotted salamander - 3,5
painted turtle - 3,5
bullfrog - 3,5
dragonfly - 3,5
waterboatman - 3,5
squirrel - 1,2,4,5
turkey vulture - 1,4
deer - 1,2,4,5
ruffed grouse - 1,2
timber rattlesnake - 1,2
ant - 1,2,4,5
fox - 1,2,4,5
rabbit - 2,4,5

6. Now we're ready to play. Ask the students to go to the hoop that represents their habitat. They must place at least one foot inside the hoop to "claim" their space.

7. The teacher calls out a cause for habitat loss.
Examples:
- a road is built through the land
- flooding causing erosion to fill in the vernal pool
- a dam is built and flooding occurs

8. Where will the animals go when their habitat is threatened or lost? The teacher should remove a hoop representing the loss of a habitat. Ask the students to move another habitat that can support them. Are they successful? What happens?

9. Discuss what caused the habitat loss.

10. What options do animals have?

- they can stay and die
- move to a new habitat and compete
- wander out of the reservation and take their chances

11. Call out another cause of habitat loss and remove another hoop. What happens now?

For discussion:

- What happened as more causes were introduced?
- How did students feel as the habitat became more crowded?
- What happened to the species dependent on more restricted habitat?

Did you know...

Fort Devens/Nashua River is a treasure trove of natural resources, including dozens of state and federally listed endangered species. Found in this area are at least 40 nests of Blanding's turtles, 71,000 acres of wetlands, and thousands of acres of contiguous diverse wildlife habitat. Efforts are underway to expand the Oxbow Wildlife Refuge to include South Post of Fort Devens.

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Activity: Migration Headache

Objective:

Students will act as migratory birds and understand the threats to their survival along the migratory route as well as in their wintering or nesting habitat.

Background:

The primary threats to the survival of migratory water birds are the disappearance and degradation of wetlands. Without wetlands, dozens of species of ducks, geese, swans, and other water birds face loss of the necessary habitat for survival. Many federal, state, and private groups recognize the importance of wetlands to wildlife. Millions of acres of wetlands have been purchased and protected to actively preserve and restore habitat for local wildlife and the vast flocks of migratory birds that span continents on their journeys.

Materials:

- large playing field or gymnasium
- two paper plates for every three students (clearly mark the plates to differentiate top from bottom) or use 12" x 12" carpet samples available at no cost from most carpet retail stores

Procedure:

1. Select a large playing area about 70 feet in length. Place the paper plates in two patches on the playing field with sufficient running room between the two patches. Choose the number of plates so that you have one plate for every three students at each end of the field. Designate one of these areas the "wintering habitat" and the other the "nesting habitat." This means you have two sets of plates; one at the nesting habitat and one set at the wintering habitat.

2. Explain to the students that they are water birds and will migrate between these two areas at your signal. Tell them that the paper plates represent "wetlands." These wetlands provide suitable habitat for water birds. At the end of each journey, the students will have to have one foot on a paper plate in order to be allowed to continue. If they cannot get their foot on a plate, that means they have not found any suitable habitat. They "die," and have to move—at least temporarily—to the sidelines and watch. During migration, the birds may want to "flap their wings," moving like birds in flight.

3. Explain to the students that many factors will limit the survival of populations of migrating water birds. Some involve changes in the wintering and nesting habitats. There will be times of abundant food, water shelter, and space suitably arranged to meet the habitat requirements of the

birds. There will be other times when the habitat is stressed, with many factors limiting the potential for survival. Sometimes the area of available habitat is reduced. Tell the students that for purposes of this activity only three water birds can occupy a "habitat haven" (paper plate) at any one time.

4. Begin the activity with all the students at the wintering habitat. Announce the start of the first migration. Have the students migrate in slow motion until they become familiar with the process. Then they can speed up. On the first try, all the birds will successfully migrate to the nesting habitat.

5. Explain that there has been no loss in the area of available habitat. Thus, a successful nesting season is at hand.

6. Before the students migrate toward the wintering habitat, turn over one plate from the wintering region. Explain that a large wetland area has been drained and used for agricultural purposes. Repeat the instruction to migrate and send the ducks to the wintering habitat. Have the three students that will be displaced stand on the sideline. Tell the students that these three died as a result of loss of habitat. Remind any "dead birds" that they will have a chance to get back into the activity. They can come back as surviving hatchlings when favorable conditions prevail and there is habitat available in the nesting ground. NOTE: The series of migration cycles can be graphed. Many teachers have chosen this method to record the cycles.

7. Before the next migration to the nesting region, turn over four plates in the nesting habitat. This represents a catastrophic loss. Tell the students that this is the result of an oil spill in the local river, severely damaging shoreline habitat. Instruct the students to migrate. NOTE: This results in a large number of students waiting on the sidelines to re-enter in the nesting habitat. Before many cycles are repeated, provide them with an opportunity for re-entry. Each time, give the students examples of changes in the habitat conditions that could have taken place, making it possible for them to survive. Two students can be made permanent monitors to turn the paper plates over as you instruct them.

8. Repeat the process for eight or ten migration cycles to illustrate changes in habitat conditions with resulting effects on the birds. Give examples of factors that might influence the birds' survival. (See list below for suggestions.)

Factors limiting survival of populations of migratory birds:

- wetland drainage
- pollution and contamination of water
- urban expansion
- conversion of wetlands to farm land
- conversion of natural waterways to canals
- illegal hunting

- lead shot in food supply
- disease

Factors favoring survival of populations of migratory birds:

- preservation of wetlands
- restoration of habitat
- dynamic balance with predators
- human action aimed at protecting and restoring wetlands, including through education
- regulation of hunting and human predation
- banning the use of lead shot

(Source: Project WILD, ©1983, 1985, Western Regional Environmental Education Council, *Migration Headache.*)

Discussion:

- What barriers do neotropical songbirds encounter as they migrate from Northeastern U.S. to the Central and South American tropics?
- How do our actions help or hurt migrating birds?

Did you know...

the Hessel's Hairstreak butterfly is an indicator of the health of the rare white cedar swamp ecosystem, the only habitat in which it breeds. This tiny green, red, and silver butterfly was discovered in the 1950s living at the tops of cedar trees on the South Shore of Massachusetts and Cape Cod. There are potential breeding sites for this species in the Westborough Cedar Swamp. The butterfly is at the northern limit of its range in Massachusetts.

Activity: Opinion Polls

Objective:

To help students identify their own values and attitudes toward wildlife and to expose them to other people's attitudes and values that may be different from their own.

Procedure:

1. Discuss some or all of the following questions with your class. You might choose to do this as a class discussion or as small group work.
   - •Is it more important to save an endangered plant or endangered animal?
   - •Suppose that your school would like to build a new science center, but the location for the building is on a vernal pool that is a breeding site for the marbled salamander. Should the school go ahead and build the center? Why? Would you give the same answer if you knew a pair of bald eagles were nesting on the site? Why?
   - •For each pair listed below, is one more important to save? Why?
     - °small animals or large animals
     - °animals that are useful to people for food or clothing or animals that have no value as a resource for humans
     - °animals or plants
     - °animals that are beautiful or those that are not appealing
     - °mammals or invertebrates
2. You are part of a team that is responsible for saving ten species from the list below, however, you have only enough time and money to save five of the species. How would you go about deciding what species should be saved? Why? Can you rank your top five? (See Appendix and coloring poster for species illustrations.)
   - °Golden Club
   - °Small Whorled Pogonia
   - °Narrow-leaved Spring Beauty
   - °Elderberry Borer Beetle
   - °Regal Fritillary
   - °Roseate Tern
   - °Water Shrew
   - °Eastern Spadefoot Toad
   - °Blue-spotted Salamander
   - °Wood Turtle
   - °Peregrine Falcon
   - °Golden-winged Warbler
   - °Northeastern Beach Tiger Beetle

(adapted with permission from "Get the Connection," Ranger Rick's Endangered Species edition of Nature Scope)

Activity: **Wildlife Dilemmas**

Objective:

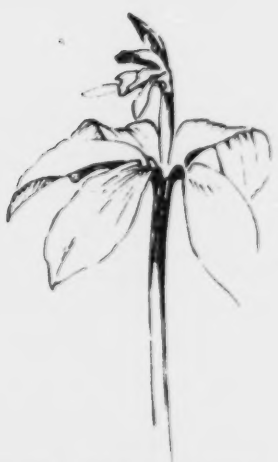
To have students examine their own beliefs and values about wildlife, listen to and try to understand the reasons behind the beliefs of others, and to evaluate possible actions.

Procedure:

1. From the following pages, copy and cut up the dilemma cards.

2. Divide the class into groups of four and give each group one card to work on at a time. The group should discuss the opinion of each member, but work towards reaching a consensus on group opinion. The group present its opinions on the solution to the dilemma to the rest of the class.

3. Presentations by each group to the rest of the class.



Small Whorled Pogonia

Dilemma Cards

Your family has always enjoyed going to the beach. This year when you arrive, you discover a portion of the beach has been closed to vehicles due to nesting piping plovers, an threatened shorebird. You

- park in the parking lot and walk to a portion of the beach that is not part of the nesting area
- walk very carefully around the birds and sit very quietly
- ignore the signs and hope that no one will see your vehicle on the section of the beach where the plovers are nesting
- complain to the warden and start a campaign to change this
- other

You're visiting a friend and discover that he/she is keeping an endangered turtle as a pet in an aquarium. You

- tell him/her that it is an endangered species and encourage him/her to let it go
- report your friend to the authorities
- say nothing and mind your own business
- other

You're out walking in the woods with your best friend. You stumble upon a rocky outcrop, and you see what might be a timber rattlesnake. Before you can confirm it by getting any closer, your friend has picked up a rock and killed the animal. What do you do?

- nothing and pretend the incident never happened
- report the incident to authorities but not saying your friend killed it
- turn in your friend to the authorities
- other

You are on a picnic with your family, and you see another family leaving to go home, without having picked up their own trash. It is clear the other family is going to leave litter all around. You

- move quickly and ask them to pick up their trash before they leave
- wait for them to leave and pick up the trash for them
- do nothing
- other

Follow up:

Ask your students to write their own dilemma cards based on their own experiences or issues that they know about. General topics might include: abandoning pets to fend for themselves to try to find new homes; impact of pets on wildlife, such as cats catching wild birds and dogs chasing deer; use of pesticides in gardens; acid rain; picking wildflowers and fruit; feeding wildlife around your home.

(C 1983, 1985 Western Regional Environmental Education Council. Adapted with permission from *Ethi-Reasoning* Project WILD.)

Did you know...

This spring marks the start of the second field season of Massachusetts Audubon's five-year Herp Atlas Program. Nearly 200 volunteers have submitted over 800 photos, tapes, and specimens of Massachusetts reptiles and amphibians including some rare and surprising finds. A good night to watch for herps is "Big Night" in March or April when many species of salamander including blue-spotted salamanders migrate to vernal pools to breed.

Action Steps for You and Your Students

•Spend time outdoors getting to know the plants and animals around where you live. Keep a journal and record what you observe in a journal.
•Volunteer to help a conservation organization on projects, e.g., cleaning beaches, counting species, building bird and bat houses.
•Sponsor an endangered species poster contest in your school to raise awareness of students and faculty.
•Read an environmental book, pamphlet, or magazine article, and share it with your class.
•Boycott products that might have come from threatened or endangered species.
•Certify a vernal pool as a class project.
•Raise money to support groups working to protect endangered species, e.g., sponsor a walk-a-thon to raise money to adopt a whale.
•Learn about the Massachusetts and federal laws that protect species and their habitats in your area and tell your friends and neighbors.
•Contact the Massachusetts Audubon Society for a citizens action kit on how to help with the passage of a strong federal Endangered Species Act.
•Attend a Project WILD workshop and sponsor an in-service training for the teachers in your school.
•Don't buy exotic pets taken from the wild.
•Brainstorm other ideas with your students and create a plan of action.

Appendix A

Endangered Species Law History

•**1782**. The Bald Eagle was designated the national symbol of America. The advent of legislation to protect species is more recent.
•**1886** The Massachusetts Legislature prohibited the hunting or killing of heath hens between January 1 and August 1, ant the hunting or killing of passenger pigeons, gulls and terns between May 1 and October 1.
•**Late 1800s and early 1900s.** Both Canada and the U.S. passed legislation to protect bison; only a few small herds existed at that time.
•**1900** The Lacey Act was passed.
•**1903** President Theodore Roosevelt established the first wildlife refuge at Pelican Island off the coast of Florida.
•**1907** The Massachusetts Commission on Fisheries and Game, the Massachusetts Audubon Society, Federation of Bird Clubs of New England, Massachusetts Fish and Game Protective Association, and the National Association of Audubon Societies joined forces to actively protect and restore the heath hen.
•**1908** The Commonwealth of Massachusetts purchased 600 acres and leased another 1000 on Martha's Vineyard, to serve as a refuge for the protection of the heath hen.
•**1914** The last passenger pigeon died in the Cincinnati Zoo.
•**1916** The United States National Park Service was established. This set aside particular areas for protection, but not necessarily for particular species or habitat protection.
•**1918** The Migratory Bird Treaty Act was passed, prohibiting the hunting or capture of most species of migratory birds, and establishing hunting seasons and harvest limits on migratory game birds.
•**1932** The last heath hen was spotted on Martha's Vineyard. Heath hens became extinct due to overhunting and habitat destruction as heath lands became forests due to fire suppression.
•**1940** The Bald Eagle Protection Act was passed because the birds were endangered as a result of overhunting and pesticide poisoning.
•**1962** Rachel Carson published *Silent Spring* , which called attention to the danger of pesticides. But it was not until 1972 that hard pesticides including DDT were banned from most uses in the United States.
•**1966** The Endangered Species Preservation Act was passed; this law listed only native animal species as endangered and provided limited protection.
•**1969** The Endangered Species Conservation Act was passed to provide additional protection to species in danger of global extinction.
•**1972** The Marine Mammal Protection Act was passed, protecting all marine mammals in U.S. waters from harassment, capture, hunting, or killing.
•**1973** The United States and other nations ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES restricts

international trade in wild animals and plants. More than ninety countries have agreed to abide by its guidelines.

•**1973** The Endangered Species Act was passed, combining and strengthening previous law, specifically defining the terms "endangered" and "threatened;" it prohibits "taking" (harming them or their habitat) as well as importing, exporting or transporting across state lines. It provides limited habitat protection for projects involving public lands and expenditures of public funds and mandates the U S Fish and Wildlife Service to develop and implement a recovery plan for each species. The law was reauthorized in 1978, 1982, and 1988.

•**1982** The International Whaling Commission voted to enact a temporary halt on commercial whaling, helping to protect whale species worldwide.

•**1990** Massachusetts Endangered Species Act. M.G.L. c 131 A. Landmark legislation prohibits the taking, possession, transportation, exportation, procuring, selling of any species listed as endangered, threatened or of special concern--requires review of impacts on designated endangered species habitat prior to approval of land development.

Appendix B

Teacher Resources

Eden's End: The Case for Ecological Protection in Massachusetts. Massachusetts Audubon Society. 1988. Revised and updated 1993.

Endangered Species: Wild and Rare. Ranger Rick's NATURESCOPE, Vol. 3, No. 3. National Wildlife Federation. Washington D.C. 1987.

Project WILD. C 1983, 1985 Western Regional Environmental Education Council. Reprinted (or adapted) with permission from Project WILD. Contact: Marion Larson, Massachusetts Division of Fisheries and Wildlife, Field Headquarters, Westboro, MA 01581, (508) 792-7270. Co-sponsored in Massachusetts with the Massachusetts Audubon Society.

Endangered Species: Resources and Activities, Hitchcock Center for the Environment, 525 South Pleasant Street,Amherst, MA 01002

The following briefly annotated resources are worth exploring. Each will enhance and expand your study of endangered species. Address queries directly to the agency or company listed as prices and availability of materials are subject to change.

Resources to Enhance and Support Your Study

Massachusetts Audubon Society
Education Department
Hatheway Library and Resource Center
South Great Road, Lincoln, MA 01773
Publications Catalog Available
Teacher workshops available on topics of natural history, schoolground science, and environmental issues

Division of Fisheries and Wildlife
Field Headquarters
Westboro, MA 01581
In addition to Project WILD, the division offers educational programs including a watershed education program, an aquatic resources program and other topical programs.

Project WILD is co-sponsored in Massachusetts by the Division of Fisheries and Wildlife and the Massachusetts Audubon Society. To find out more about this program and to schedule a teacher workshop, contact Marion Larson, Massachusetts Division of Fisheries and Wildlife, Field Headquarters, Westboro, MA 01581, or Cleti Cervoni, Education Department, Massachusetts Audubon Society, South Great Road, Lincoln, MA 01773.

The US Fish and Wildlife Service offers materials including the *Endangered Species Issues Pac*, a packet of information and activities, and Biologues, a series of free fact sheets on endangered species. Teachers' guides, posters, and species lists are also available. The newest packet is on the piping plover.

US Department of the Interior
Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035

The Hitchcock Center for the Environment offers *Endangered Species: Resources and Activities*.

Hitchcock Center for the Environment
525 South Pleasant Street
Amherst, MA 01002

The Massachusetts Natural Heritage and Endangered Species Program provides information sheets on most endangered, threatened and of special concern plant and animal species.

Massachusetts Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
100 Cambridge St.
Boston, MA 02202

The Fund for Animals has posters on endangered species available.

Fund for Animals
P.O. Box 14302
Dayton, OH 45414

The National Audubon Society offers the Endangered Species Toolkit which contains a bumper sticker, fact sheets, and information about writing letters to congress and agencies.

National Audubon Society
950 Third Ave.
New York, NY 10002

Youth for Endangered Species is a bimonthly periodical written by and for students.

Youth for Endangered Species
c/o Sylvia Altman
11611 26th Ave. South
Seattle, WA 98168

ZooBooks distributes Endangered Species (Vol. 1, No. 7, January 1984). This issue covers various aspects of the topic; an accompanying teaching unit with activities, including a role-playing game, is also available.

Wildlife Education, ltd.
930 W. Washington St.
Suite 14
San Diego, CA 92103

Defenders of Wildlife offers sets of endangered species fact sheets and posters; each double-sided poster features two animals.

Defenders of Wildlife
1244 19th St., NW
Washington DC. 20036

The National Science Teachers Association has posters on endangered species.

National Science Teachers Association
1742 Connecticut Ave., NW
Washington DC. 20009

The National Institute for Urban Education offers Endangered Species Issues which provide information, activities, and lesson plans for teaching about endangered species.

National Institute for Urban Wildlife
10921 Trotting Ridge Way
Columbia, MD 21044

The Animal Protection Institute distributes Understanding Endangered Species: An Education Kit, which features a filmstrip with cassette, information sheets for students, teacher's guide, and brochures.

Animal Protection Institute
P.O. Box 22505
Sacramento, CA 95822

The National Wildlife Federation's NATURESCOPE series features Endangered Species: Wild and Rare, an issue that includes activities, information sheets for students, and background information for teachers.

National Wildlife Federation
1412 16th St., NW
Washington D.C. 20036

At the Crossroads is a film that introduces problems that face North American endangered species.

Stouffer Productions
300 Spring St.
Aspen, CO 81611

Say Goodbye is a film that presents a direct approach to the problems of endangered species.

Fims, Inc.
733 Green Bay Rd.
Wilmette, IL 60091

Vanishing Animals of North America and Vanishing From the Earth are filmstrips with accompanying cassettes.

National Geographic Society
Educational Services
Washington D.C .20036

Rare and Endangered Animals, Extinction, Rare and Endangered Birds and Reptiles of the World, and Rare and Endangered Mammals of the World are slide shows with accompanying text. Endangered Species is a filmstrip with cassette.

Carolina Biological Supply Company
2700 York Rd.
Burlington, NC 27215

Endangered and Extinct Animals and Rare and Endangered Animals Parts I and II are slide shows with accompanying text.

Educational Images, ltd.
PO. Box 3456, West Side
Elmira, NY 14905

Endangered Species - Wildlife Needs You is a slide show with accompanying cassettes.

National Wildlife Federation
1412 16th St., NW
Washington D.C. 20036

Appendix C

MASSACHUSETTS ENDANGERED (E), THREATENED (T), AND SPECIAL CONCERN (SC) SPECIES

AMPHIBIANS
Blue-spotted Salamander (SC)
Eastern Spadefoot (T)
Four-toed Salamander (SC)
Jefferson Salamander (SC)
Marbled Salamander (T)
Spring Salamander (SC)

BIRDS
American Bittern (SC)
Arctic Tern (SC)
Bald Eagle (E, FE)
Blackpoll Warbler (SC)
Common Barn-owl (SC)
Common Loon (SC)
Common Moorhen (SC)
Common Tern (SC)
Cooper's Hawk (SC)
Eskimo Curlew (E, FE)
Golden-winged Warbler (E)
Grasshopper Sparrow (SC)
Henslow's Sparrow (SC)
King Rail (T)
Leach's Storm-petrel (E)
Least Bittern (T)
Least Tern (SC)
Loggerhead Shrike (E)
Long-eared Owl (SC)
Mourning Warbler (SC)
Northern Harrier (T)
Northern Parula (T)
Peregrine Falcon (E, FE)
Pied-billed Grebe (T)
Piping Plover (T, FT)
Roseate Tern (E, FE)
Sedge Wren (E)
Sharp-shinned Hawk (SC)
Short-eared Owl (E)
Upland Sandpiper (E)

FISH
American Brook Lamprey (T)
Atlantic Sturgeon (E)
Burbot (SC)
Eastern Silvery Minnow (SC)
Lake Chub (E)
Longnose Sucker (SC)
Northern Redbelly Dace (E)
Shortnose Sturgeon (E, FE)
Threespine Stickleback (T)

INVERTEBRATES
American Burying Beetle (E, FE)
Appalachian Brook Crayfish (SC)
Attenuated Bluet (SC)
Bank Tiger Beetle (SC)
Barrens Bluet (T)
Barrens Buckmoth (T)
Barrens Daggermoth (T)
Barrens Metarranthis (SC)
Barrens Tiger Beetle (SC)
Beaver Pond Clubtail (SC)
Blueberry Sallow (T)
Boreal Turret Snail (E)
Brook Snaketail (SC)
Bucholz's Gray (T)
Chain Dot Geometer (SC)
Chain Fern Borer (SC)
Clemens' Hawkmoth (SC)
Coastal Heathland Cutworm (SC)
Coastal Marsh Snail (SC)
Coastal Swamp Amphipod (SC)
Coastal Swamp Metarranthis (SC)
Cobra Cubtail (SC)
Comet Darner (SC)
Coppery Emerald (E)
Dwarf Wedgemussel (E, FE)
Early Hairstreak (T)
Eastern Pondmussel (SC)

Ebony Boghaunter (E)
Elderberry Borer (SC)
Gerhard's Underwing (T)
Golden Aster Flower Moth (T)
Harpoon Clubtail (E)
Hentz's Redbelly Tiger Beetle (T)
Heracleum Stem Borer (SC)
Hessel's Hairstreak (SC)
Imperial Moth (SC)
Intricate Fairy Shrimp (SC)
Kennedy's Emerald (E)
Massachusetts Clam Shrimp (SC)
Melscheimer's Sack Bearer (T)
Midland Clubtail (E)
Mocha Emerald (SC)
Mustard White (SC)
Mystic Valley Amphipod (SC)
New England Bluet (SC)
New England Medicinal Leech (SC)
New Jersey Tea Inchworm (T)
Northeastern Beach Tiger Beetle (E, FT)
Northern Brocade Moth (SC)
Northern Hairstreak (SC)
Northern Spring Amphipod (SC)
Ocellated Darner (SC)
Olive Vertigo (SC)
Ostrich Fern Borer (SC)
Pale Green Pinion Moth (SC)
Persius Duskywing (T)
Piedmont Groundwater Amphipod (SC)
Pilsbry's Spire Snail (E)
Pine Barrens Itame (SC)
Pine Barrens Zale (SC)
Pine Barrens Zanclognatha (T)
Pink-edged Sulphur (SC)
Pitcher Plant Borer (SC)
Puritan Tiger Beetle (E, FT)
Purple Tiger Beetle (SC)
Regal Fritillary (E)
Riffle Snaketail (T)
Ringed Boghaunter (E)
Ringed Emerald (SC)
River Moss Animal (SC)
Riverbank Looping Snail (E)
Riverine Clubtail (E)
Scudder's Clubtail (E)
Skillet Clubtail (SC)
Slender Emerald (SC)
Spartina Borer (SC)
Spine-crowned Clubtail (E)
Spring Blue Darner Dragonfly (E)
Straight Lined Mallow Moth (SC)
Swollen Wedgemussel (E)
Taconic Cave Amphipod (E)
Three-lined Angle Moth (SC)
Tidewater Mucket (SC)
Tule Bluet (SC)
Twelve-spotted Tiger Beetle (SC)
Twilight Skimmer (SC)
Walker's Limpet (SC)
Water-willow Stem Borer (T)
Williams' Tigermoth (T)
Yellow Lampmussel (E)

MAMMALS
Blue Whale (E, FE)
Fin Whale (E, FE)
Gray Seal (SC)
Humpback Whale (E, FE)
Indiana Myotis (E, FE)
Northern Right Whale (E, FE)
Rock Shrew (SC)
Sei Whale (E, FE)
Small-footed Myotis (SC)
Southern Bog Lemming (SC)
Sperm Whale (E, FE)
Water Shrew (SC)

REPTILES
Atlantic Ridley (E, FE)
Black Rat Snake (E)
Blanding's Turtle (T)
Bog Turtle (E)
Copperhead (E)
Diamondback Terrapin (T)
Eastern Box Turtle (SC)
Green Turtle (T, FT)
Hawksbill (E, FE)
Leatherback (E, FE)
Loggerhead (T, FT)

Plymouth Redbelly Turtle (E, FE)
Spotted Turtle (SC)
Timber Rattlesnake (E)
Wood Turtle (SC)
Worm Snake (T)

PLANTS

a Filmy-fern (T)
Acadian Quillwort (E)
Adder's-tongue Fern (T)
Alternate-flowered Water-milfoil (T)
American Sea-blite (SC)
American Waterwort (E)
Andrew's Bottle Gentian (T)
Annual Peanutgrass (E)
Arborvitae (E)
Arethusa (T)
Autumn Coralroot (SC)
Bailey's Sedge (E)
Barren Strawberry (SC)
Bartram's Shadbush (T)
Basil Mountain-mint (E)
Beaded Pinweed (E)
Bicknell's Hawthorn (E)
Black Cohosh; Bugbane (E)
Black Maple (SC)
Black-fruited Woodrush (E)
Boreal Wormwood (E)
Braun's Holly-fern (E)
Bristly Black Currant (SC)
Bristly Buttercup (T)
Bristly Foxtail (SC)
Britton's Violet (T)
Broad Tinker's-weed (E)
Broad Waterleaf (E)
Broom Crowberry (SC)
Bur or Mossy-cup Oak (SC)
Bush's Sedge (E)
Bushy Rockrose (SC)
Canadian Sanicle (T)
Canefly Orchid (E)
Capillary Beak-sedge (E)
Cat-tail Sedge (T)
Chestnut-colored Sedge (E)
Climbing Fumitory (T)
Climbing or Hartford Fern (SC)
Comb Water-milfoil (T)
Commons's Panic-grass (SC)
Cornel-leaved Aster (E)
Creeping Sedge (E)
Creeping St. John's-wort (T)
Crested Fringed Orchis (E)
Crooked-stem Aster (SC)
Culver's-root (SC)
Davis's Sedge (E)
Devil's-bit or Fairy Wand (E)
Dioecious Sedge (T)
Downy Arrowwood (T)
Downy Wood-mint (E)
Drooping Speargrass (E)
Dwarf Mistletoe (SC)
Dwarf Rattlesnake-plantain (E)
Dwarf Scouring-rush (SC)
Eastern Saline Sedge (E)
Eastern Silvery Aster (E)
Eaton's Beggar-ticks (T)
Engelmann's Umbrella-sedge (SC)
Estuary Arrowhead (E)
Estuary Beggar-ticks (E)
False Pennyroyal (E)
Fen Cuckoo Flower (T)
Fen Sedge (SC)
Few-flowered Sedge (E)
Few-flowered Spike-sedge (E)
Few-fruited Sedge (T)
Fibrous Bladderwort (T)
Fir Clubmoss (E)
Foxtail Clubmoss (E)
Foxtail Sedge (T)
Fragile Rock-brake (T)
Frank's Lovegrass (SC)
Fries's Pondweed (T)
Gattinger's Panic-grass (SC)
Giant St. John's-wort (T)
Ginseng (SC)
Glaucescent Sedge (E)
Glaucous Sedge (E)
Golden Club (T)
Golden Seal (E)
Grass-leaved Ladies'-tresses (SC)
Gray's Sedge (T)
Great Blue Lobelia (T)

Great Laurel (T)
Green Dragon (T)
Green Rock-cress (T)
Gypsywort (T)
Hairy Agrimony (T)
Hairy Beardtongue (E)
Hairy Honeysuckle (E)
Hairy-fruited Sedge (T)
Hairy Wild Rye (T)
Hairy Wood-mint (E)
Handsome Sedge (T)
Heartleaf Twayblade (E)
Hemlock Parsley (SC)
Hill's Pondweed (SC)
Hitchcock's Sedge (SC)
Hooded Ladies'-tresses (E)
Houghton's Flatsedge (E)
Intermediate Spike-sedge (T)
Inundated Horned-sedge (T)
Knotted Pearlwort (T)
Labrador or Fen Bedstraw (SC)
Lake Quillwort (E)
Large-leaved Goldenrod (T)
Large-leaved Sandwort (T)
Leafy White Orchis (T)
Lesser Snakeroot (E)
Linear-leaved Milkweed (T)
Lion's Foot (E)
Long-beaked Bald-sedge (SC)
Long-leaved Bluet (T)
Long-leaved Panic-grass (T)
Long's Bitter-cress (E)
Long's Bulrush (E)
Long-styled Sanicle (T)
Low Bindweed (E)
Lyre-leaved Rock-cress (T)
Many-fruited False-loosestrife (T)
Maryland Meadow Beauty (E)
Mattamuskeet Panic-grass (E)
Michaux's Sandwort (SC)
Michaux's Sedge (E)
Midland Sedge (E)
Mountain Alder (SC)
Mountain Cranberry (E)
Mountain Spleenwort (E)
Mountain Winterberry (T)
Muskflower (T)
Nantucket Shadbush (SC)
Narrow-leaved Spring Beauty (T)
Narrow-leaved Vervain (E)
New England Boneset (E)
Nodding Chickweed (E)
Nodding Pogonia or Three Birds (E)
Northeastern Bulrush (E, FE)
Northern Bedstraw (E)
Northern Bog Violet (T)
Northern Gama-grass (E)
Northern Mountain-ash (E)
Northern Prickly Rose (E)
Ovate Spike-sedge (E)
Oysterleaf (E)
Pale Green Orchis (T)
Papillose Nut-sedge (E)
Parker's Pipewort (E)
Pendulous Bulrush (SC)
Philadelphia Panic-grass (SC)
Pink Pyrola (E)
Pinnate Water-milfoil (SC)
Plymouth Gentian (SC)
Pod-grass (T)
Pondshore Knotweed (SC)
Prickly Pear Cactus (T)
Purple Clematis (SC)
Purple Cress (E)
Purple Cudweed (E)
Purple Milkweed (T)
Purple Needlegrass (T)
Putty-root; Adam-and-Eve (E)
Pygmyweed (T)
Ram's-head Lady's-slipper (E)
Rand's Goldenrod (E)
Red Mulberry (E)
Redroot (SC)
Rigid Flax (T)
River Arrowhead (E)
River Bulrush (SC)
Rough Panic-grass (T)
Round-fruited False-loosetrife (T)
Roundleaf Shadbush (SC)
Salt Reedgrass (SC)
Saltpond Grass (T)
Saltpond Pennywort (SC)

Sand Violet(E)
Sandbar Cherry (SC)
Sandbar Willow (SC)
Sandplain Blue-eyed Grass (SC)
Sandplain Flax (SC)
Sandplain Gerardia (E, FE)
Schweinitz's Sedge (E)
Sclerolepis (E)
Sea Lyme-grass (E)
Sea Pink (E)
Seabeach Dock (T)
Seabeach Needlegrass (SC)
Sessile Water-speedwell (E)
Shining Wedgegrass (T)
Shore Sedge (T)
Short-beaked Bald-sedge (T)
Showy Lady's-slipper (SC)
Silverling (E)
Slender Blue-eyed Grass (T)
Slender Cottongrass (T)
Slender Marsh Pink (E)
Slender Woodland Sedge (E)
Small Bur-reed (E)
Small Dropseed (E)
Small Whorled Pogonia (E, FE)
Small Yellow Lady's-slipper (E)
Small-flowered Agrimony (E)
Smooth Rock-cress (T)
Smooth Woodsia (E)
Snowberry (E)
Spiked False-oats (E)
Spreading Tick-trefoil (E)
Spurred Gentian (E)
St. Andrew's Cross (E)
Strigose Knotweed (SC)
Subulate Bladderwort (SC)
Swamp Dock (T)
Swamp or Fen Birch (T)
Swamp Lousewort (E)
Swamp Oats (T)
Swamp Red Currant (SC)
Sweet Coltsfoot (T)
Sweetbay Magnolia (E)
Tall Nut-sedge (E)
Terete or Slender Arrowhead (SC)
Thread Rush (T)
Threadfoot (SC)
Three-angled Spike-sedge (E)
Tiny Cow-lily (T)
Tiny-flowered Buttercup (T)
Tiny-fruited Spike-sedge (E)
Toothcup (E)
Torrey's Beak-sedge (E)
Tradescant's Aster (SC)
Tuckerman's Sedge (E)
Tufted Hairgrass (E)
Two-flowered Bladderwort (T)
Two-flowered Rush (E)
Upland White Aster (T)
Variable Sedge (E)
Violet Wood-sorrel (T)
Wall-rue Spleenwort (T)
Walter's Sedge (E)
Wapato (E)
Weak Rush (E)
White Adder's-mouth (T)
Wiegand's Sedge (E)
Wild Senna (E)
Winged Monkey-flower (E)
Woodland Millet (T)
Woundwort (T)
Wright's Panic-grass (SC)
Yellow or Muhlenberg's Oak (SC)

FE - Listed as Federally Endangered by the U.S. Fish & Wildlife Service

FT - Listed as Federally Threatened by the U.S. Fish & Wildlife Service

November, 1993

Massachusetts Natural Heritage Program

Natural Heritage Program
MA Division of Fisheries and Wildlife
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Vernal Pools

What is a Vernal Pool?

Vernal pools are temporary bodies of freshwater that provide crucial habitat to several vertebrate and many invertebrate species of wildlife. The word "vernal" means spring, and indeed, most vernal pools are filled by spring rains and snowmelt, only to dry up during the hot dry months of summer. Many vernal pools are filled again by the rains of autumn and may persist throughout the winter. Vernal pools are typically small; they rarely exceed 150 feet in width and are usually shallow. In fact, vernal pools that support rich communities of amphibians and invertebrates may measure only a few yards across.

Where are Vernal Pools Found?

Vernal pools are common in Massachusetts, probably occurring in every town in the state. Vernal pools may be found anywhere where small depressions, swales or kettle holes collect spring runoff or intercept seasonally high groundwater tables. Although many people associate vernal pools with wooded areas, ecologically valuable vernal pools may also be found in meadows, sand flats and river floodplains.

Why are Vernal Pools Valuable?

Vernal pools constitute a unique and increasingly vulnerable type of wetland that is inhabited by many species of wildlife, some of which are totally dependent on vernal pool habitat for their survival. Since vernal pools are temporary bodies of water, they cannot support fish populations. The absence of fish predation on amphibian eggs and larvae is crucial to the successful breeding of the Wood Frog (*Rana sylvatica*) and the four local species of mole salamanders (*Ambystoma* spp.). Other amphibian species, including the American Toad (*Bufo americanus*), Green Frog (*Rana clamitans*) and Red-Spotted Newt (*Notophthalmus viridescens*), often exploit the fish-free waters of vernal pools, although they regularly breed in permanent ponds as well. Vernal pools also support a rich and diverse invertebrate fauna. Some invertebrate species, such as fairy shrimp, spend their entire lives in vernal pools. The invertebrates constitute a rich source of food for amphibian larvae, and also attract various species of birds, mammals and reptiles to vernal pools.

Are Vernal Pools a Threatened Resource?

Yes. Prior to November 1987, vernal pools in Massachusetts were not given protection under the state's Wetlands Protection Act. As a result, many vernal pool depressions were filled as part of the rapid development that has occurred throughout the Commonwealth in the past several decades. Three species of mole salamanders that require vernal pools for breeding are now considered rare in Massachusetts.

Are Vernal Pools Automatically Protected by the Massachusetts Wetlands Protection Act?

No. In order to qualify for protection under the Wetlands Protection Act, vernal pools must clear two hurdles. First, a vernal pool must be certified as valuable vernal pool habitat by the Massachusetts Natural Heritage and Endangered Species Program. Only vernal pools that meet certain biological and physical criteria can be certified.

Second, to be protected, a vernal pool must be located within a "Wetland Resource Area", as defined in the regulations of the Wetlands Protection Act. Although at this time, it is impossible to estimate the percentage of certifiable vernal pools that will not meet the above criteria, it is clear that most certifiable vernal pools will not be protectable.

How Can Vernal Pools Be Certified?

The certification program depends entirely on the initiative of interested individuals and organizations.

Interested parties should:

1. Contact the Massachusetts Natural Heritage and Endangered Species Program (NH&ESP) to obtain copies of the document entitled "Guidelines for Certification of Vernal Pool Habitat", along with several "Vernal Pool Field Observation Forms" (NH&ESP address given on facing page);

2. Locate potential vernal pools - remember to ask for permission from the landowner before searching for vernal pools on private property - and complete the "Field Observation Forms"; and

3. Submit the "Field Observation Forms", along with supporting evidence*, to the NH&ESP for review.

*The preferred type of evidence needed for meeting the biological certification criteria is photographic documentation of breeding by Wood Frogs or mole salamanders (Spotted, Blue-Spotted, Jefferson or Marbled Salamanders), or the presence of fairy shrimp.

Upon receipt of the request for vernal pool certification, the NH&ESP will consider the completeness and accuracy of the information and documentation presented. The applicant will be informed as to whether or not the pool has been granted certification, or whether more information is needed before a decision can be made. The locations of certified vernal pools will be made known to the local conservation commission.

If you wish to know whether or not a particular vernal pool is located within a Wetland Resource Area, the best people to contact are the members of your local conservation commission. General information regarding the Wetlands Protection Act, as well as the names and addresses of local conservation commissioners, can be obtained by calling the Massachusetts Association of Conservation Commissions at (617) 381-3457.

Remember that only vernal pools that are both certified and located in a Wetland Resource Area are afforded legal protection.

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MASSACHUSETTS RARE AND ENDANGERED PLANTS

Natural Community Fact Sheet
Wetlands of Massachusetts
Salt Marshes

Description

Located between the high spring-tide and mean-tide levels of protected coastal shores, salt marshes comprise one of the most productive ecosystems on Earth. In spite of the stresses of wide variations in temperature, level of salinity, and degree of inundation, the salt-tolerant vegetation of the salt marsh community provides the basis of the complex food chains in both estuarine and marine environments. In addition, salt marshes provide habitat for various species of wildlife--including migrating and overwintering waterfowl and shorebirds and the young of many species of marine organisms. In the northeastern United States, salt marsh communities are dominated by two species of perennial, emergent, halophytic (adapted to growth in salty soils) grasses--Saltmarsh Cordgrass (*Spartina alterniflora*) and Saltmeadow Cordgrass (*Spartina patens*). While these dominant species give the community a deceptively simple, grassland-like appearance, salt marshes are actually complexes of several communities, from salt shrub zones, high marsh and low marsh, to tidal creeks, and pannes (poorly drained depressions that develop in the marsh).

Status

Since the arrival of the first Europeans, Massachusetts has lost a large portion of its salt marsh habitat. The Boston area was originally the site of an extensive salt marsh, most of which was destroyed by dredging and filling of Back Bay. Between the end of World War II and the mid-seventies, Massachusetts lost approximately 20,000 acres--a third of the total acreage it had at the beginning of this period. Fortunately, little development now occurs in salt marsh areas. Current threats to salt marshes include some development, dredging for docks and marinas, and ditching for mosquito control--all of which change the water drainage patterns, and hence, the viability of the community.

1993

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Natural Community Fact Sheet
New England Terrestrial Forest Communities
Spruce - Fir Forest

Description

The spruce - fir forest is a northern (cold temperate) forest community. The community has relatively few species in any of the vegetation layers. Few herbs or seedlings can grow in the reduced light that reaches the forest floor through the evergreen canopy.and the forest floor typically has a thick layer of needles between the patches of mosses that grow on stumps and fallen trunks and branches. It is also known as a mesic northern conifer forest, montane spruce - fir forest, boreal forest, or the northeastern spruce - fir forest.

Environment

The evergreen canopy trees and their associates are adapted to a relatively short growing season with low average temperatures. There is normally plentiful moisture in the habitat, including from low lying cloud cover over the mountains. The lower elevational limit of the community has been suggested to be set by the normal height of low hanging clouds. The soils are thin and acidic, formed over granite, schist, or gneiss bedrock, and often steeply sloped. The soil usually has a relatively thick humus layer: the acidity, cool conditions and short frost-free season slow decay and mixing of the organic materials into the soils, resulting in a slow turn-over of nutrients and the humus containing a high percentage of the available nutrients.

The high elevation spruce - fir forests of Massachusetts often have stunted trees of 5 - 10m (15 -30 ft), probably from the strong winds in the mountains, but the heavy winter snows, ice, and low nutrient availability must also contibute.

An interesting feature of spruce - fir forests is wave regeneration which is a distinctive type of disturbance where the wind throws the tallest trees and leaves that area open for regeneration. Behind the fallen trees are zones of maturing and regenerating trees. Within the closed forest, regeneration is primarily occurs in areas with increased sunlight, opened by a tree dying or falling.

(continued overleaf)

March 1990

Characteristic species of Spruce-fir forests in Massachusetts

The dominant species are red spruce and balsam fir, the proportion of which increases with elevation. Yellow birch (Betula alleghaniensis), black birch (B. lenta), heart-leaf paper birch (B. cordifolia), and hemlock (Tsuga canadensis) are other species that occur in the canopy at much lower density than the dominants. The forest floor is dark all year, which results in much sparser understory than in deciduous forests. There may be a high shrub layer with red elderberry (Sambucus pubens), mountain holly (Nemopanthus mucronatus), or northern mountain ash (Sorbus americana). A low shrub layer may have bunchberry (Cornus canadensis), twinflower (Linnaea borealis), velvetleaf blueberry (Vaccinium myrtilloides), or creeping snowberry (Chiogenes hispidula). Species of the herb layer include wood sorrel (Oxalis acetosella), Canada mayflower (Maianthemum canadensis), goldthread (Coptis trifolia), starflower (Trientalis borealis), bluebead lily (Clintonia borealis), painted trillium (Trillium undulatum), and ferns (Dryopteris spp). Several mosses, including hair cap moss (Polytrichum spp) and feather mosses, grow in thick mats on fallen logs.

Range

Red spruce and balsam fir are near the southern end of their range in central New England. Spruce - fir forests occur rarely in Massachusetts, always at high elevation: the northern flank of the Berkshire Plateau and the peaks of Mt Greylock, Mt. Wachusett, and Mt. Watatic. Regionally, they are found at high elevations of southern Vermont and New Hampshire and at decreasing altitudes towards the northern parts of Vermont, New Hampshire, Maine and New York.

A variant of the community with black spruce occurs at lower altitudes of Massachusetts on the Berkshire Plateau, and northern Worcester and Middlesex Counties, in low, poorly drained sites.

Status in Massachusetts

Much of the habitat of the spruce - fir forest in Massachusetts has been very disturbed at the mountain summits where clearing for views, parking, and ski slopes has been ongoing for over a hundred years. Below the summits of the mountains the community has some protection, but the occurrences are fragmented patches. Spruce decline is another significant disturbance of the community type: the cause of the trees not doing well is variously thought to be acid rain, other pollutants, beetles or fungi, singly or in combination.

Natural Heritage & Endangered Species Program

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Natural Community Fact Sheet
Pitch pine/Scrub oak Barrens

Description

Pitch pine/scrub oak barrens are an open shrubland plant community, that occurs on outwash sandplains. Pitch pine/scrub oak barrens, also called oak/pine scrub or pine barrens, typically have an open canopy of pitch pine and a nearly impenetrable understory of scrub oaks up to 2-3 meters (7-10 feet) tall and shorter huckleberry about a meter (3 feet) tall.. There is often a mosaic of scrub oak which may be thick enough to exclude other plants, openings with lowbush blueberry, bearberry, or lichen, and grassland or heathland in low areas. White pine may also occur in less dry sites. Areas with tree oaks or abundant pine trees of either species are considered to be woodland or forest, not barrens.

Environment

Pitch pine/scrub oak barrens occur on deep, coarse, well-drained sands derived from glacial outwash, in the coastal plain, the Connecticut River Valley, and other scattered areas throughout the northeast. The sands are acidic, nutrient poor and drought prone. The low vegetation and sandy soils contribute to a tendency to be hotter than more mesic sites on summer days, with greater cooling at night, so have great temperature variations daily. The dry environment with low humidity contributes to the loss of heat at night, as in a desert. Exposure to the temperature variations may make plants more susceptible to other damaging factors such as insects or disease. In pitted outwash plains or rolling moraines, some low bowls, or kettles, are frost pockets and have more heath and lichen and less oak and pine. Deeper kettles may intersect the water table and have a Coastal Plain Pond at the bottom.

Pitch pine/scrub oak barrens are a fire maintained and fire dependent type of natural community: some of the component species depend on recurrent fires for their existence, and many of the species have volatile oils that actually encourage the spread of fires once they are ignited. Species of the community tend to be adapted to occasional light fires: scrub oaks and huckleberries sprout readily from their root crowns and pitch pine has thick bark that resists fire damage. Pitch pine can grow new branches from the stem, and it produces some cones that release their seeds only when heated by fire. Such species can sprout back vigorously once the fire has passed; other species of invading trees don't survive the fire. Some of the herbaceous species have long lived seeds that stay in the duff for years and germinate after fire; the plant becomes abundant for the first few years after a fire before the larger plants grow sufficiently to shade them out. Fire increases the rate of nutrient cycling: organic material that is slow to rot in the site's dry conditions releases its nutrients in a pulse in the ash after a fire. The pulse of nutrient availability results in lush growth of the plants in the first few years, with increased variety of insects that eat the plants, and birds that eat the insects and berries of the plants. Prescribed burns that remove accumulated dead needles and leaves on a regular basis can be used to reduce the danger from wildfires, and help maintain the natural community. Studies have shown that diversity of native species is greatest in recently burned pitch pine/scrub oak barrens, and decreases with time after a fire, as scrub oak increases its dominance.

Pitch pine/scrub oak barrens can be a successional stage: if there is no disturbance such as fire, tree oaks and white pine can invade and take over. Other sites may receive seeds of the forest species, but recurrent disturbances limit

Massachusetts. Small populations of both plants and animals have reduced genetic variability, and thus reduced ability to respond to changes in the environment. Populations that are already stressed may not recover from losing a generation of adults, such as occurs after spraying for Gypsy moths or mosquitoes which reduce populations of all species of adult butterflies and moths. Although plant species tend to be better able to recover from disturbances than animal species (plant seeds may stay dormant in the soil for years and other plants can occur vegetatively in remnants), fragmentation will ultimately also reduce viability of small populations of plants.

Many acres of scrub oak/pitch pine barrens are in state parks, wildlife management areas, and town lands, but there are many competing uses of these lands, fire suppression has been almost complete, and few of the areas are managed to maintain the specific natural community type.. The community would best be maintained by careful reintroduction of fire through prescribed burning or other fire management plans. Other disturbances that don't fragment the community also help maintain the natural mosaic of pitch pine/scrub oak areas.

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Natural Community Fact Sheet
Freshwater Tidal Marshes

Description:

Freshwater tidal marshes have a diverse flora, with herbaceous plants, grasses, and rushes all growing mixed together. Vegetation zones are present, although seldom distinct. The lowest areas have aquatic floating and emergent plants, and the higher areas support a taller mix of plants, often dominated by cattails or sweet flag, or wild rice in late summer. There is a pronounced seasonal sequence of plant dominance, with the lower areas going from bare mud to broad-leaved plants (such as arrow-arum), then to dominance by grasses and herbaceous plants. Variations in diversity of species composition and growth form are typical of freshwater tidal marsh communities.

Environment

Freshwater tidal marshes occur on rivers near the coast at the uppermost ranges of tidal influence- the water is fresh to slightly brackish, but rises and falls with the tides. The resultant daily inundation and drying poses particular stresses for the plants that live there, and the frequency and duration of flooding seem to be the factors controlling distribution of component plant species. Freshwater tidal marshes occur where the gradient of the river is low, and water movement fluctuates under the influence of the tides. As low tide approaches, the waters of the high tide drain across the marshes carrying runoff from the uplands. These waters are rich in nutrients and minerals, making the ecosystem extraordinarily productive. Cross marsh streams cut through the marsh sediments and add to the structural, and vegetative diversity of the sites. The streambeds are usually mud and sand, with the tidal marsh substratum a slightly acidic muck and peat. This type of natural community falls into both estuarine and riverine classifications. The salinity concentration varies with the weather--it would be higher when particularly high tides extend farther up the rivers than is normal or when freshwater runoff is reduced due to drought. Freshwater tidal marshes occur in a continually changing transition zone between freshwater and saltwater. These unique ecosystems combine features of tidal salt marshes and the diversity of inland freshwater marshes.

Species of Freshwater Tidal Marshes in Massachusetts

Naturally, the predominant plants are hydrophytes (water adapted) and most are herbaceous emergent species. The vegetation is similar to that of inland marshes: there is a continuum between the vegetation of freshwater tidal marshes and inland freshwater marshes. Most of the aquatics encountered are emergents that are flexible and most have tough rhizomes and roots that sometimes form resistant mats (for example, arrow-arum (*Peltandra virginica*), Pickerel weed (*Pontedaria cordata*), Arrowheads (*Sagittaria latifolia and S. rigida*), and yellow water lily (*Nuphar luteum*)). Herbaceous annuals such as jewelweed (*Impatiens* spp), smartweeds and tearthumbs (*Polygonum* spp), and bur-marigolds (*Bidens* spp.) are among the plants encountered in areas scoured by strong fall and winter tidal currents. Sweetflag (*Acorus calamus*), tall reed grass (*Phragmites communis*) in non-aggressive populations, both cattails (*Typha angustifolia* and *T. latifolia*), spike-sedges (*Eleocharis* spp.), bulrushes (*Scirpus* spp.), and bur-reeds (*Sparganium* spp.) are common perennials of the freshwater tidal marsh. Cordgrasses and saltmeadow hay (*Spartina* spp) that dominate salt marshes do not dominate in the freshwater tidal marshes, although other grasses such as wild rice (*Zizania aquatica*) and sedges may be important components of the freshwater tidal marsh community.

(continued overleaf)

June 1990

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Species of Freshwater Tidal Marshes in Massachusetts (continued)

The freshwater tidal marsh community includes many state listed rare species, including Parker's Pipewort (*Eriocaulon parkeri*), Long's Bitter-Cress (*Cardamine longii*), River Arrowhead (*Sagittaria subulata*), Estuary Beggar-ticks (*Bidens hyperborea*), and Pygmyweed (*Crassula aquatica*). The structural diversity of the vegetation (broad leaved plants, grasses, and shrubs interspersed with open water) supports a high diversity of bird life. Ducks and geese, freshwater snakes and turtles, and insects are more diverse in freshwater tidal marshes than in saltwater tidal marshes, although the fish, molluscs and zooplankton fauna is much less diverse.

Range:

Freshwater tidal marshes are more common along low gradient rivers than along rivers that are steep to the sea or have rocky shorelines. They occur less often in areas with barrier beaches because of decreased tidal amplitudes. The general community type can be found from Quebec to Georgia and the Gulf Coast, but the areas with greatest development are the mid-Atlantic region and South Carolina to Georgia. The Hudson and Connecticut Rivers have freshwater tidal marshes to just north of Albany and Hartford, respectively. Maine and New Hampshire have small freshwater tidal marsh communities. The only large area north of southern New England with extensive freshwater tidal marshes is the St. Lawrence River system. There are regional differences in the flora of these freshwater tidal marshes, although the communities are structurally similar. The best freshwater tidal marshes in Massachusetts occur on the Merrimack, North, Agawam, and Weweantic Rivers. Other coastal rivers have small patches or degraded representatives of the community type, when it occurs.

Status in Massachusetts

Freshwater tidal marshes are uncommon natural communities in Massachusetts: they are limited by geology and geography to short stretches of tidal rivers in coastal areas. Freshwater tidal marshes are often close to developed areas and have been partially filled or destroyed by channelization of the rivers, and have been impacted by oil, pesticides, and heavy metal effluent, and excess nutrients from septic and sewage systems. Three rivers that used to have good freshwater tidal communities, the Mystic, Charles, and Saugus Rivers have completely lost them due to damming and other human alterations. The North and Merrimack Rivers have about 1000 acres of freshwater tidal marshes between them. Other rivers such as the Agawam and Weweantic Rivers in Wareham have good but small representatives of the community type. The North and Merrimack Rivers are undergoing intensive development as the their water quality is improved and more people want to use them for recreation and abutting housing. There are intense pressures to clear the edges for better access for boats or to put in docks. Part of the freshwater tidal marsh along the North River is protected by the presence of a large adjacent freshwater swamp, which is difficult to develop. Some of the freshwater tidal marsh along the Agawam River has been protected by the town, and conservation restrictions or voluntary protection agreements are being sought on the best areas of freshwater tidal marsh along the Merrimack.

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Oak-hickory Woods

Oak-hickory woods are the most common type of vegetation in the eastern and central part of Massachusetts. The constituent species are also widespread, and not many rare species occur in the community. Good examples of this community type occur on warm, dry sites such as south and west facing slopes. Oaks and hickories dominate the community. Many of the oak and hickory species are restricted in their northward distribution by intolerance to extended cold. The actual species composition varies with the moisture regime and the geographic location. White pine, red maple and white ash trees are common in all but the driest sites. Beech, hemlock, and white birch are part of the community in the cooler and moister areas.

Most oak-hickory woods have a continuous canopy cover at about 20 meters. There is a well developed subcanopy that includes smaller individuals of the canopy species, witch hazel, hop hornbeam, and American chestnut. Shrubs such as huckleberry, blueberry, maple-leaved viburnum, alternate-leaved dogwood, pink azalea, and arrow-wood grow as scattered individuals, and mountain laurel makes thick continuous colonies. Except for mountain laurel areas, the tall shrub layer is not excessively dense. Lowbush blueberry often forms a continuous low layer.

Many of the herbaceous plants are perennials and are able to spread by underground stems to form colonies. Many such as wintergreen, partridge berry, and several shinleafs are evergreen, enabling them to use spring sunlight before the canopy leaves appear in the spring. Canada mayflower, pink ladyslipper, starflower, and several ferns and clubmosses may form extensive mats. The herb layer is less diverse than in a rich, mesic hardwood community. Rare plants such as whorled pogonia, cranefly orchid, and climbing fern occur in some specialized microhabitats within the community.

Leaves decay slowly and accumulate for many years in the acid, fairly dry conditions typical of acid oak forests. The substrate may be granite bedrock or acid sands and gravels of glacial till or outwash plains. The soils are nutrient poor and have little organic matter incorporated into them.

Massachusetts Natural Heritage Program

Floodplain forests

The best floodplain forests occur along the Connecticut River and its tributaries, the Housatonic, and the Merrimack River. Seasonal flooding enriches the soil with organic matter and silts from upstream. The soils are often silty or sandy near the river.

The canopy may be closed or somewhat open, with trees up to 25 m tall. Silver maple, black willow, sycamore, cottonwood, green ash and American elm are among the most common trees of the flood plain. Areas that are regularly flooded have trees and herbs, with few shrubs or young trees. Areas with less regular flooding have more woody shrubs and small trees. In spring, there is no ground cover in the floodplain, with the perennial ostrich ferns growing up through the recently deposited silt. Later in the year the ferns are supplemented by annuals such as jewelweed, clearweed, and an almost continuous layer of wood nettles. Vegetation of the floodplain forest's wetter areas grades to that of swamps and marshes. A few of the state's rare plants grow at the edge of the floodplain: sandbar willow and Frank's love-grass are found in the full sun, on the less stable soils near the river. Green dragon grows in the floodplain forest and in adjacent meadows. Winged monkey flower occurs along some small tributary streams. Davis's sedge, one of the rarest of New England plants, grows in the floodplain forest on the Housatonic.

Although the plants of floodplains can withstand, or even benefit by, spring flooding, late season floods can reduce plant diversity and ultimately cause soil loss, returning the site to earlier stages of succession. During floods the trees may be injured by water or ice borne materials. Trees may be undercut and tip over, damming the water and causing increased deposition of silt and debris from upstream. Sometimes trees though knocked down, remain partially rooted and their branches grow upwards, becoming a row of young trees. Because of the dynamic nature of rivers and their banks, the location of the floodplain forests may change with time. Their rich soils were recognized early on by settlers, so extensive areas of our floodplains have been converted to agriculture.

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NATURAL COMMUNITY FACT SHEET

Southern New England Terrestrial Communities
NEW ENGLAND COASTAL HEATHLANDS

DESCRIPTION

New England heath sand barrens--or coastal heathlands, as they are commonly known--are open, nearly treeless communities dominated by low-growing members of the Heath family (Ericaceae) and located either on stabilized dunes or plains of glacial deposits. Heathlands have been described as mat-like or tundra-like in appearance and, on Nantucket, are known as moors. Various heaths and heath-like species thrive in the rugged environment of extreme daily and seasonal temperature variations, nutrient-poor soil, intense sunlight, and salt-laden winds. Patches of open soil and areas covered with foliose lichens create a mosaic pattern . Although coastal heathlands are natural communities, until the late 19th century human activities actually increased their range. The setting of fires by Native Americans and logging and grazing of livestock by Europeans opened up habitat for heathland species. Since the late 1800's, however, land development, suppression of fires, and lifestyle changes have led to a drastic decline in this unique community *and* in many interesting and rare species associated with it. One of the best and largest examples of coastal heathland can be seen in Nantucket.

ENVIRONMENT

Coastal heathland plants are pioneering species well able to cope with the harsh environments and poor soils of stabilized dunes and glacial sandplains. In fact, it's thought that the original, most natural occurrences of coastal heathland were in the salt spray zone, where other species don't compete well. Nevertheless, colonization by heath vegetation can lead to succession by less hardy species, including trees, that will eventually out compete the pioneers. For example, in Nantucket, succession by Scrub Oak (Quercus ilicifolia) and Pitch Pine (Pinus rigida) has supplanted heathland species. And both land development and suppression of fire prevent other heathland habitats from opening up. While they share many species, the heathland communities of southern New England are of two broad types: the dune heathland community and the glacial deposit upland, or glacial plain, community. Both are composed of low-growing plants, including several species that can reproduce clonally. The stabilized dune community is greatly influenced by sand movement: Many of the plant species growing here can grow up through as much as 5 -10 cm (2 - 4 in.) of wind-deposited sand. Glacially deposited upland communities have more stable substrates but are also more vulnerable to invasion by shrubs and trees. Like most communities, coastal heathlands form part of a gradient of communities. Coastal heathlands grade into sandplain grasslands--possibly due to less wind, less salt, or more ground moisture. A type of hybrid community, in which species typical of both coastal heathlands and sandplain grasslands, called grassy heath can occur as well. Finally, in low-lying, open areas of Pine Barrens, communities very like coastal heathlands occur.

CHARACTERISTIC SPECIES IN MASSACHUSETTS

Common plants of heathlands include Early Lowbush Blueberry (*Vaccinium angustifolium*), Late Lowbush Blueberry (*Vaccinium vacillans*), Pennsylvania Sedge (*Carex pensylvanica*), Bayberry (*Myrica pensylvanica),* Mayflower or Trailing Arbutus (*Epigaea repens*), and Little Bluestem (*Andropogons scoparius).* When they are dominant, the following species are considered to be indicators of heath sand barrens: Bearberry (*Arctostaphylos uva-ursi*), Black Huckleberry (*Gaylussacia baccata*), Broom Crowberry (*Corema conradii*), Golden Heather (*Hudsonia ericoides*), and False Heather (*Hudsonia tomentosa*). Plants that are found in the dune heathland, but that only rarely occur in the upland heath community, include Beach Pea (*Lathyrus japonicus*), Seaside Goldenrod (*Solidago sempervirens*) and (*Hudsonia tomentosa).* Many plants that are considered rare in Massachusetts occur in the heathland

communities of New England, including Nantucket Shadbush (*Amelanchier nantucketensis)*, Butterfly Weed (*Asclepias tuberosa*), Blue-eyed Grass (*Sisyrinchium arenicola)*, Broom Crowberry (*Corema conradii*), Eastern Silvery Aster (*Aster concolor*), Sandplain Flax (*Linum intercursum*), Purple Cudweed (*Asclepias purpurascens*) and Bushy Rockrose (*Helianthemum dumosum*).

Bird species that nest in coastal heathlands, though few, include Horned Lark (*Eremophila alpestris*), Savannah Sparrow (*Passerculus sandwichensis*), Vesper Sparrow (*Pooecetes gramineus*) and the Short-eared Owl (*Asio flammeus*), an endangered species in Massachusetts that has one of its main food sources in the voles that live in heathlands. Birds of prey (or raptors) that may be seen hunting over the moors include Red-tailed Hawk (*Buteo jamaicensis*), American Kestrel (*Falco sparverius*), Merlin (*F. columbarius*), the endangered Peregrine Falcon (*F. perregrinus*) and the Northern Harrier (*Circus cyaneus*), which is threatened in Massachusetts. During the summer and fall, small numbers of shorebirds--particularly sandpipers and plovers--may feed and rest on the moors. Other animals that can be found in heathlands include the Red-bellied Snake (*Storeria occipitomaculata*), the Meadow Vole (*Microtus pennsylvanicus*), the Short-tailed Shrew (*Blarina brevicauda*) and such common insects as the Monarch butterfly (*Danaus plexippus*) and the Pearly Crescent Spot (*Phycoides tharos*). Several species of insects that are considered rare in the state can also be found in coastal heathlands, including the Chain-dotted Geometer (*Cingilia catenaria)* , the Coastal Heathland Cutworm (*Abagrotis crumbi benjamini*), the Purple Tiger Beetle (*Cicindela purpurea*), the Barrens Buckmoth (*Hemileuca maia*) and the Regal Fritillary (*Speyeria idalia*).

RANGE

Coastal heathlands occur from Nova Scotia and the northern coast of Maine to northern New Jersey. (In New York, the communities are called maritime heathlands. Those in Maine and Nova Scotia represent a northern variation of heathland.) Massachusetts's heathland communities are found on Cape Cod, Nantucket, Martha's Vineyard, and the Elizabeth Islands. Heath on Nantucket totals several thousand acres.

STATUS

The heathland community is considered to be threatened throughout its range. It has been estimated that about ninety per cent of coastal heathland in the northeastern United States has been lost since the middle of the nineteenth century. Reasons for this loss include suppression of fires, cessation of grazing by livestock in the affected areas, development of land, coastal erosion, and succession by trees and non-heathland shrubs. Excessive foot traffic and the use of off-road vehicles also threaten heathlands. Damage can be done by just one vehicle passing over the habitat; fifty passes of a vehicle will devegetate the surface. Prescribed burning and controlled grazing are being examined for efficacy in maintaining remaining heathlands.

Natural Heritage & Endangered Species Program

Natural Community Fact Sheet:

August, 1987

ATLANTIC WHITE CEDAR SWAMP

Description

AWC swamps are forested wetland communities characterized by a dense primarily evergreen canopy, a deciduous shrub layer, and a sparse, depauperate herb layer dominated by mosses.

Environment

AWC swamps occur primarily on the Coastal Plain in low freshwater wetlands. Sand, capped by a water-saturated peat, is usually found under the community. Soil pH is acidic, (3.1 - 5.5). Standing water occurs in most cedar swamps for half of the growing season or longer. The water and soil (mostly organic) are usually nutrient poor: particularly low in nitrogen and phosphorus. The leaf litter is slow to decay, with a high carbon:nitrogen ratio and high a tannin content. There is a high iron content in the soil that was mined as "bog iron" in the early days of manufacturing.

Characteristic Species of AWC in Massachusetts

The AWC swamp is characterized, of course, by Atlantic White Cedar (Chamaecyparis thyoides), a tree of the Cypress family, Cupressaceae, with short branches and evergreen, scale-like leaves that form a soft, flat spray. It grows to 80' (25 m) with a straight trunk with cinnamon-brown to grey peeling bark and a twisting grain. AWC swamps are often composed of nearly pure stands of Atlantic White Cedar, but Red Maple (Acer rubrum) may be a co-dominant, along with lesser amounts of Blackgum (Nyssa sylvatica), Yellow Birch (Betula alleghaniensis), and White Pine (Pinus strobus).

The shrub layer is composed of hollies and ericaceous shrubs. The former include Common Winterberry (Ilex verticillata), Smooth Winterberry (I. laevigata), Inkberry (I. glabra), and the related Mountain-Holly (Nemopanthus mucronatus). The ericaceous shrubs include Sweet Pepperbush (Clethra alnifolia), Swamp Azalea (Rhododendron viscosum), Highbush Blueberries (Vaccinium corymbosum and V. atrococcum) and Swamp Sweetbells (Leucothoe racemosa). Poison-sumac (Rhus vernix) is frequently encountered.

The herb layer is dominated by Sphagnum mosses (Sphagnum spp.). Also present may be Goldthread (Coptis trifolia), Northern White Violet (Viola pallens), and Virginia Chain fern (Woodwardia virginica).

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Several rare species are known from AWC swamps. These include Heartleaf Twayblade (Listera cordata), an orchid currently found in only one location in Massachusetts, Dwarf Mistletoe (Arceuthobium pusillum), Parula warbler (Parula americana), and a butterfly, Hessel's Hairstreak (Callophrys hesseli), that only occurs in AWC swamps.

Range

AWC swamps are found mostly along the Atlantic Coastal Plain from Maine to North Carolina and along the Gulf Coast in western Florida, Alabama, and Mississippi. Sporadic occurrences are found in north central Florida, Georgia, and South Carolina.

Status in Massachusetts

AWC swamps occur most commonly south and southeast of Boston with scattered occurrences to the north and west. AWC swamps have been much diminished in size and number during the last 300 years. Many have been converted to agriculture or filled for development, others were mined for "bog iron". Also Atlantic White Cedar has been cut extensively for posts and shingles for over three centuries. Atlantic white Cedar tends to occur in even aged stands. Since AWC is unable to reproduce under a hardwood canopy, improper harvesting practices will result in replacement by hardwood species, particularly Red Maple.

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MASSACHUSETTS RARE AND ENDANGERED PLANTS

GOLDEN CLUB

(Orontium aquaticum L.)

DESCRIPTION

As the scientific name implies, Golden Club is an aquatic species. The flowering stalk is white-stemmed with a golden fertile tip extending up to 6 inches or more from the water. The leaves are deep, dull green above and paler beneath. Depending on water level, they may be ascending or floating and are approximately 5-12 inches long. Orontium aquaticum is perennial and blooms in April and May. Following flowering, the Golden Club inflorescence begins to arch over so that the inflorescence is completely under water during fruit production.

HABITAT IN MASSACHUSETTS

O. aquaticum prefers silty, muddy, or peaty bottoms in shallow water of ponds, bogs, marshes, and slow rivers.

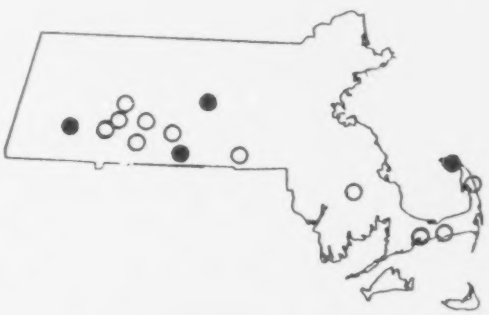
RANGE

Golden Club ranges from Massachusetts and New York to Florida, and west to Louisiana and western parts of Kentucky and Tennessee.

POPULATION STATUS

Golden Club is classified as "Threatened" in Massachusetts. Since 1978, this species has been reported from 11 sites in the state; records from 14 additional locations were reported prior to that time. The decline of Golden Club populations has been attributable to loss of habitat, particularly in the Connecticut River Valley and its rarity is in part due to its location here at the northern edge of its range.

Distribution of Golden-Club



● Verified since 1978
○ Reported prior to 1978

Distribution in Massachusetts by Town

1985

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MASSACHUSETTS RARE AND ENDANGERED PLANTS

Small Whorled Pogonia
Isotria medeoloides (Pursh) Raf.

DESCRIPTION The Small Whorled Pogonia is a slender orchid which grows up to 10 inches tall when flowering and up to 14 inches when fruiting. The stem ends in a whorl of 4 to 6 pale-green elliptic leaves that are 1 to 3.5 inches in length.

One or two lime-green flowers (about 3/4 in. long) grow from the center of the whorl on short stalks. The flowers are composed of three petals; the lowest of the three having a greenish lip at its tip. Surrounding the petals are 3 separate, narrow, pale green sepals (outer floral leaves) which grow between 1/2 to 3/4 inches long. Fruiting capsules are erect with the fruit stalk length approximately equal to that of the capsule (.7-1.2 in. long).

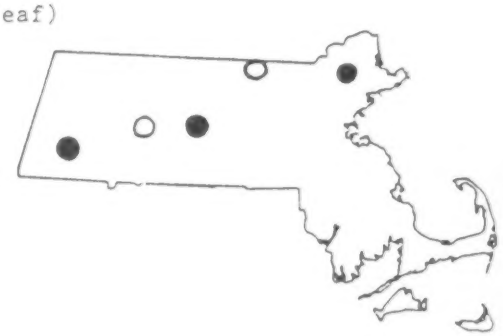
LIFE HISTORY/ECOLOGY The Small Whorled Pogonia can remain dormant for 2 years or more making its reproductive history difficult to study and its age difficult to determine. Growth is initiated by mid May and flowering by the second week of June. The flowers last for 7 to 10 days. The leaves turn yellow and die in September and seeds are expelled from their capsules after October 15. The buds which indicate the following year's growth are visible in mid September.

SIMILAR SPECIES Isotria verticillata is similar to Isotria medeoloides but can be distinguished from the latter by the shape of the sepals. Sepals of Isotria verticillata are over 1 1/2 inches long, purplish, and wide-spreading. The sepals of Isotria medeoloides' are much shorter, greenish, and are situated more closely to one another. Another species, Indian Cucumber Root (Medeola virginiana), a plant of the Lily Family, is also similar in appearance to the Small Whorled Pogonia. However, Indian Cucumber Root stems are wirey, and often covered by a white fuzzy material.

RANGE This orchid is found in Maine and Ontario in the north, west to Michigan, Illinois, and Missouri, and south along the Eastern Seaboard to Georgia. It is rare throughout its

(continued overleaf)

Distribution of
Isotria medeoloides



● Verified since 1978
○ Reported prior to 1978

Distribution in Massachusetts by County

1988

range, with the largest concentrations occurring in Maine and New Hampshire.

HABITAT IN NEW ENGLAND Historically, the habitat supporting Isotria medeoloides was not well documented. In recent years however, this species' habitat has been consistently reported as forested slopes composed of "Very Stony Fine Sandy Loam" soil types where water movement is restricted by a fragipan. Fragipans are brittle loamy cement-like layers below the surface of the soil which are low in porosity and force the water to drain laterally instead of vertically. The soil above the fragipan is very acidic and very low in nutrients.

In Massachusetts, this plant is found on slightly sloping previously logged forest land made up of extremely acidic and granitic soils. Like other sites known to support this orchid, the Massachusetts sites are composed of seasonally moist areas above a fragipan. Light conditions are usually filtered rather than shaded or open.

A significant number of plants are associated with this type of habitat and are considered indicator species for the rare orchid when they are found together in plentiful numbers. Associated forest species include: Red Maple (Acer rubrum), Hemlock, (Tsuga canadensis), Canoe Birch (Betula papyrifera), Red Oak (Quercus rubra), White Pine (Pinus strobus), Beech (Fagus grandifolia), Large-toothed Aspen (Populus grandidentata). A natural community including Canoe Birch with dense fern undergrowth is often associated with Isotria medeoloides. Also, Witch-hazel (Hamamelis virginiana) is always abundant where Isotria medeoloides grows.

Associated herb species (when they are present) are woodland ferns such as Dennstaedtia punctilobula, Thelypteris noveboracensis, and Osmunda spp. Evergreen herbaceous species found are: Wintergreen (Gaultheria procumbens), Mayflower (Epigaea repens), Spotted Wintergreen (Chimaphila maculata), Partridge Berry (Mitchella repens), and Shinleaf species (Pyrola spp.). Other species of orchids which are often found with Small Whorled Pogonia are: Pink Lady-slipper, (Cypripedium acaule), Rattlesnake Plantain (Goodyera pubescens), Coralroot species (Corallorhiza maculata and C. odontorhiza), and Three Birds Orchid (Triphora trianthophora).

POPULATION STATUS The Small Whorled Pogonia is listed as Endangered by the U. S. Fish and Wildlife Service and by the Massachusetts Division of Fisheries and Wildlife. This species is one of the rarest orchid species in northeastern North America. As of 1987, there were only 75 extant populations of Isotria medeoloides worldwide composed of less than 5,000 individuals. Historically, this species is known in 18 states and Ontario; today it is known in only 15 states. Vermont, Maryland, and Missouri are those states which formerly supported this orchid. Currently, there are only 3 populations known in Massachusetts. Historically, this plant was known from only two other sites in the state.

The lack of suitable habitat is the most significant factor contributing to this orchid's rarity. Specifically, habitat destruction and alteration combined with vandalism and illegal plant collection threaten Isotria medeoloides. As this species is so rare, it is much sought after by collectors who have illegally uprooted and destroyed individual plants for specimen collection. There is no evidence that this species can be successfully transplanted, so any plants that are uprooted are lost forever.

This orchid requires very specific habitat to succeed and will not occur in other areas. Although the plant is found along vernal streams and in thick, highly acidic, organic duff, the surrounding land is equally important to the success of this orchid. This species relies on water moving from upslope regions down to its populations. When these vital buffer zones are altered, water movement is disrupted and the microclimate of the area often changes, creating a different habitat in which Isotria medeoloides cannot grow. It is believed that it is as important to preserve these peripheral areas as it is to preserve the habitat on which the plants occur.

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MASSACHUSETTS RARE AND ENDANGERED PLANTS

NARROW-LEAVED SPRING BEAUTY
Claytonia virginica

DESCRIPTION

The Narrow-Leaved Spring Beauty is a low herbaceous plant of the Portulacaceae Family that flowers from late April to mid May. It is a spring ephemeral, completing its life cycle by the middle of June and then wilting and disappearing. Spring Beauties range in height from 6 to 12 inches (15 to 30 cm) with a simple pair of opposite leaves occurring midway up the stem. Leaves are long, slender, and tapered to the base and lack a well-defined petiole. Leaves are between 2 and 8 inches (5-20 cm) long and are dark green. Narrow-Leaved Spring Beauties have 5 pink or whitish oval petals striped with dark pink. Flowers occur in a false raceme and are 1/2 to 3/4 of an inch (1.3-2 cm) wide with 5 stamens having pink anthers opposite the petals. The fruiting body is a small capsule enclosed by 2 sepals. This plant grows from an edible potato-like growth called a corm which was commonly eaten by Indians and colonists. Two to forty shoots may emerge from the corm of one plant.

SIMILAR SPECIES

Carolina Spring Beauty (*Claytonia caroliniana*), the other North American species in this genus found in the northeast, also is found in rich woods and resembles the Narrow-Leaved Spring Beauty. However, the former's leaves are shorter and broader, and the flowers are smaller. It prefers rich woods on high hills and mountains and therefore does not occur with Narrow-Leaved Spring Beauties in Massachusetts.

(continued overleaf)

● Verified since 1978
○ Reported prior to 1978

Distribution in Massachusetts by Town

1987

RANGE

Narrow-Leaved Spring Beauties are found from southern Quebec to Ontario and Minnesota, south to Georgia and Texas.

HABITAT

The Narrow-Leaved Spring Beauty occurs in rich, mesic, deciduous woods, thickets, or clearings composed of alluvial soils that are seasonally flooded. As is evidenced by its affinity for floodplain areas, this plant is capable of tolerating disturbance and has been observed growing in lawns and cemeteries. In Massachusetts, this plant is found under such species as sugar maple, basswood, cottonwood, silver maple, ash, and pin oak, and among low lying species such as trout lily, wood anemone, wood horsetail, purple trillium, broad-leaved goldenrod, and wild geranium.

ECOLOGY

The Narrow-Leaved Spring Beauty, whose petals close at night and on cloudy days, is intolerant of shade while flowering and therefore must bloom before the leaves of the overhead canopy expand in the spring. The 6-[illegible] flowers produced on each stem bloom at different times to facilitate the pollination process. When a flower opens, it first acts as a male, exposing its pollen to insects who are guided into the center by the petals' dark stripes. After one day, the stamens drop back allowing the anther (female part) to open up and accept pollen from other flowers of the same plant. If pollinating insects do not reach the anther by the first day, the petals will close and reopen the next day if it is sunny. If the flower has been pollinated, the petals will again close to allow the flower to produce seeds. The Narrow-Leaved Spring Beauty is pollinated by a species of bee called Andrena eriginia which is specific to this plant. The large female effectively moves inside the flower itself, covering her belly with pollen to be distributed. Bumblebees, bee flies, and butterflies pollinate this plant as well. When the seeds ripen approximately 10 days after pollination, the capsule divides ejecting them a short distance from the parent plant.

POPULATION STATUS

Claytonia virginica is listed as Threatened by the Massachusetts Division of Fisheries and Wildlife. Four current (since 1978) and 6 historical occurrences of Narrow-Leaved Spring Beauties are known in the state. It is believed that this plant has difficulty thriving in Massachusetts due to the plant's short growing season which requires consistent spring like weather of temperatures of at least 52 degrees F (11 degrees C) for flowering to take place. As is common in Massachusetts, spring months are frequently characterized by unseasonably cold and harsh weather which prevents the Narrow-Leaved Spring Beauty from prospering. Loss of suitable habitat to development and conversion of floodplains to agriculture is thought to be adversely affecting Claytonia virginica populations as well.

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MASSACHUSETTS RARE AND ENDANGERED WILDLIFE

Elderberry Borer Beetle
(Desmocerus palliatus)

DESCRIPTION: The Elderberry Borer Beetle is one of the most striking beetles found in Massachusetts. It is a member of the family Cerambycidae, or long-horned beetles. The entire body is a dark metallic blue except for the anterior third of its outer wing, which is bright gold or orange in color. It is approximately 25 mm. (1 in.) long and 7 mm.(0.3 in.) wide. The antennae of the male extend to the hind third of the wing. Those of the female extend to the middle of the wing. The antennae of both sexes are characterized by a thickening at the end of the middle segments earning the species its alternate name "Cloaked Knotty-Horn Beetle".

SIMILAR SPECIES: The Elderberry Borer Beetle is not easily confused with any other beetle species in Massachusetts. Its relatively large size and distinctive bright coloration are excellent field marks.

RANGE: The Elderberry Borer Beetle is found throughout the northeastern half of the United States and parts of eastern Canada. It is known from Massachusetts and Connecticut south to Virginia and North Carolina and west to Indiana and Kansas. In Canada it has been found in Ontario.

(continued overleaf)

Massachusetts Distribution by Town

1991

ECOLOGY/LIFE HISTORY: The flight period of adult Elderberry Borer Beetles in Massachusetts is known to extend from at least June 5 to August 9. Most observations of adults have been made between mid-June and mid-July. Adults nearly always occur in close association with elderberry bushes (Sambucus spp.), where they are usually found on the leaves or flowers. The eggs are laid on the leaves or stems of elderberry. After hatching, the larvae bore into the stems of the host plant and create long burrows running along the axis of the stem. The larvae of the Elderberry Borer Beetle are a creamy white color with a brown head and black mandibles. When full grown, the larvae are approximately the same length as the adults. It should be noted that larvae of the Elder Shoot Borer Moth (Achatodes zeae) also bore into the stems of elderberry bushes. Larvae of both the beetle and the moth may kill individual shoots of the elderberry by their feeding activities.

POPULATION STATUS IN MASSACHUSETTS: The Elderberry Borer Beetle was formerly widespread in Massachusetts but there are only a few recent records confirming its continued existence in the state. It was documented historically from at least 22 towns, but has been reported from only 4 towns since 1978. The reasons for its apparent decline are unknown. The Elderberry Borer Beetle is currently listed as a "Species of Special Concern" in the state.

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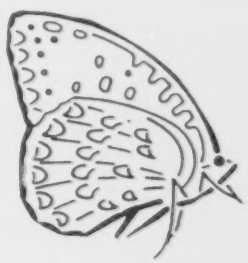
MASSACHUSETTS RARE AND ENDANGERED WILDLIFE

Regal Fritillary
(Speyeria idalia)

DESCRIPTION: The Regal Fritillary is a large and superbly beautiful butterfly with a wingspan of 8 to 11 cm (3 to 4 in.). The forewings are brown-orange with purple-black bars and spots, and a black margin; the upper surface is brighter than the underside. The female's forewings are larger, with a wider black margin containing a row of white spots. The upper surface of the hindwings are velvety blue-black, turning slightly orange towards the base, and contains two rows of spots. In females, both rows are white; the inner row is bluish-white in males and the outer row is orange. The underside of the hindwings is olive-brown with many silver spots. The female's hindwings are larger than the male's.

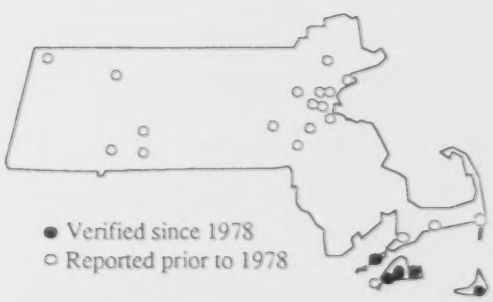


The Regal Fritillary caterpillar is about 4.5 cm (1.75 in.) in length, velvet black with red-orange to yellow stripes and six rows of fleshy, tapering spines. The two dorsal rows of spines are silver in color, turning black at the tips, while the lateral rows are orange .

SIMILAR SPECIES: There are no other fritillaries (Speyeria spp.) which have dark hindwings with light spots. The Painted Lady (Vanessa cardui) has coloration similar to the Regal Fritillary, but in a different pattern: the forewings are dark with light spots; it is also smaller than the Regal Fritillary. From a distance, the Regal Fritillary may resemble the Monarch Butterfly (Danaus plexippus), but the Regal Fritillary has a lower, swifter, more direct flight pattern.

(continued overleaf)

Range of Regal Fritillary



Massachusetts Distribution by Town
1990

RANGE: Historically, the range of the Regal Fritillary extended from Massachusetts north to New Brunswick, west to South Dakota (with scattered records in Montana, Wyoming, and Colorado), and south to Tennessee and North Carolina. Today, the species is declining throughout the eastern portion of its range; it has disappeared from North Carolina and most of New England except for the offshore islands of Massachusetts and Rhode Island.

HABITAT IN MASSACHUSETTS: The few remaining Regal Fritillaries in Massachusetts are found on the sandplain grasslands of the offshore islands. They were once found in wet meadows, boggy or marshy pastures, and along open streams. Common plants found on the sandplain grasslands include big bluestem, little bluestem (Schizachynium scoparium), poverty grass (Danthonia spicata), sand cherry, blunt-leaved milkweed,Indian grass,wild lupine, and occasionally birdsfoot violet (Viola pedata).

ECOLOGY / BEHAVIOR: The Regal Fritillary produces only one brood per year. Adult males emerge from their cocoons from late June to mid-July; females follow suit 1 to 2 weeks after the males. Mating often occurs immediately after the females have emerged, but mated pairs are more common toward the end of the long flight season (which lasts from late June or July to late September). Hundreds of eggs are laid by the females from late August to mid-September; usually oviposition is near but not on violets (Viola spp.). The eggs hatch in 3 to 4 weeks, after which the larvae immediately seek shelter beneath leaf litter and enter diapause (a state of dormancy) without feeding. The following spring, as the temperature rises, the larvae emerge from the leaf litter and feed on violets at night, but seek shelter by day. They molt 5 times, after which they form a chrysalis; 17 days later an adult Regal Fritillary emerges from the cocoon. Adult Regal Fritillaries obtain water and nutrients primarily from the nectar of various flowers: thistles (Cirsium spp.), Sweet Pepperbush (Clethra alnifolia), Northern Blazing Star (Liatris borealis), and Joe-pyeweed (Eupatorium dubium).

POPULATION STATUS IN MASSACHUSETTS: The Regal Fritillary is classified as an Endangered Species in Massachusetts; it has been documented in 24 historical sites and 17 current sites in the state, and it is likely the most endangered species of moth or butterfly in southern New England. Much of its preferred grassland habitat has been lost as fields and pastures have become reforested or overgrown due to suppression of fires or lack of grazing; development and the conversion of meadows to cranberry agriculture have also eliminated suitable habitat. Most modern pesticides are probably lethal to the Regal Fritillary; aerial spraying may have caused the elimination of the species from mainland New England. All reasonable steps should be taken to protect the few remaining populations of Regal Fritillaries; preservation of habitat along with management that protects large populations of violets and preserves nectar sources should greatly benefit the Regal Fritillary.

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MASSACHUSETTS RARE AND ENDANGERED WILDLIFE

Roseate Tern
Sterna dougalli

Description The adult Roseate Tern is a pale gray bird with a black capped head and black streaked primaries (outer feathers). It averages 15 1/2 inches (39.5 cm) in length and weighs about 113 g (4 oz.). Its cream colored underparts are tinged with pink and its white tail is long (18.4 cm) and deeply forked. Its legs are orange. For most of the year, the Roseate's bill is black with a red base. In May, the bill turns entirely black and in June and July the red band increases. Juveniles have silver upperparts patterned with narrow black V's. Their legs and bill are black and their head is black streaked with cream. The juvenile's underwing color is the same as the adult and its upper wing is primarily gray. The Roseate's harsh, rasping alarm call ("kreck, crack, or kraak") is distinctly louder and lower keyed than that of other terns and has been likened to the tearing of cloth. When undisturbed on the breeding grounds, its usual note is a soft, musical "kulick"

Similar Species The Roseate Tern is distinguished from the Common Tern (*Sterna hirundo*) by its paler gray mantel, longer tail, and thinner body. Unlike the Common Tern, the Roseate's tail streamers extend beyond the end of its folded wings. Additionally the Roseate Tern has a black bill with a reddish base while the Common Tern's is red with a black tip.

Range In North America, the Roseate Tern breeds in two discrete areas: from Nova Scotia to Long Island, New York, and From the Florida Keys and Bahamas through the Lesser Antilles. The wintering range os this species is less clearly defined. According to the American Ornithological Union, in the Americas, Roseates winter primarily in the eastern Caribbean from the West Indies southward ranging along the Atlantic coast of South America to eastern Brazil. Other sources suspect they may be pelagic in winter.

(continued overleaf)

Breeding Range in U.S.

Distribution of Roseate Tern

● Verified since 1978
○ Reported prior to 1978

Breeding Distribution in Massachusetts by Town

1988

Migration Roseate Terns arrive in M assachusetts in early May, along with the other tern species. Their departure is a two-staged affair. They leave their nesting grounds at the end of August each year and congregate for about a month at a traditional site for roosting, feeding, and teaching their young. Toward the end of September, they leave en masse and head south.

Habitat in Massachusetts The Roseate Tern prefers islands, coastal beaches, and inshore waters. Occasionally, sand dunes on barrier spits accommodate this species. It has a preference for dense cover composed of herbaceous plants such as beach grass and seaside goldenrod.

Feeding Habits The Roseate Tern is a specialist preferring to feed on sand lance and small herring. Occasionally it will eat mackerel but rarely feeds on other fish or invertebrates. This bird feeds in a variety of areas. In Massachusetts, it has been reported feeding in the open ocean up to 1 km offshore and in sheltered bays or inlets up to 2 km offshore. The Roseate Tern feeds both alone and in the company of other terns. It procures its food by diving and by snatching up the small fish being chased by larger predatory fish.

Nesting and Breeding Habits The Roseate Tern is a colonial nester always found with Common Terns. Nests consist of scrapes hidden under or next to vegetation. The Roseate Tern has been found in vegetative cover over 1 meter high. Less frequently, nests have been found under rocks, boards, and other materials. Most birds begin breeding at 3 or 4 years of age. In Massachusetts, 1 to 2 spotted tan eggs are laid asynchronously between May 17 and June 12. Younger birds lay later into the season. Both parents participate in incubating the eggs and feeding and brooding the young. The young hatch after 23 days and fledge at 25 days of age. The young remain dependent on the parents at least 6 weeks after fledging.

Predation and Defense The Roseate Tern is extremely sensitive to predation and is not able to reproduce successfully if predators are present. Nesting on islands and in thick cover are strategies employed by this tern to reduce predation threats. However, the more aggressive and earlier nesting Herring and Great Black-backed Gulls often force the Roseate Tern from its island habitats to the mainland where they are vulnerable to predation by mammals and other birds. Owls, herons, foxes, raccoons, weasels skunks, and rats commonly prey on eggs, hatchlings, and juveniles. Great Horned Owls will prey on the adults as well as on the eggs and young birds. When the terns flee from the owl, other nocturnal predators are able to raid the nests. Roseate Terns will attempt to discourage avian predation by mobbing, calling loudly, or attacking an intruder. Unlike the Common Tern, they do not exhibit strong defensive measures against mammals or humans.

Population Status The Roseate Tern is listed as "Endangered" by the U.S. Fish and Wildlife Service and the Massachusetts Division of Fisheries and Wildlife. Since 1935, there has been approximately a 70% decline in the number of Roseate Terns in northeastern North America. This species has declined from 8500 pairs in the 1930's to 2500 pairs in 1978. Massachusetts surveys from 1986 and 1987 indicate that the Roseate Tern population is remaining stable at about 1697 pairs.

Several important factors have been attributed to the precipitous decline in Roseate Tern populations in North America. Foremost is the encroachment of Herring and Great black-backed gulls on tern nesting grounds. Roseate Terns will not renest in areas where they have been unable to successfully raise a brood in previous years. In several instances, erosion, flooding, and alteration of nesting substrates have significantly reduced tern populations. This bird is additionally affected by human activity in its wintering range. Egg collecting and killing of the Roseate Tern for food occur in countries such as the U.S. Virgin Islands and Guyana.

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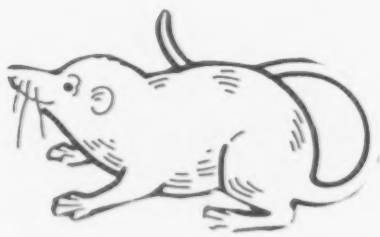
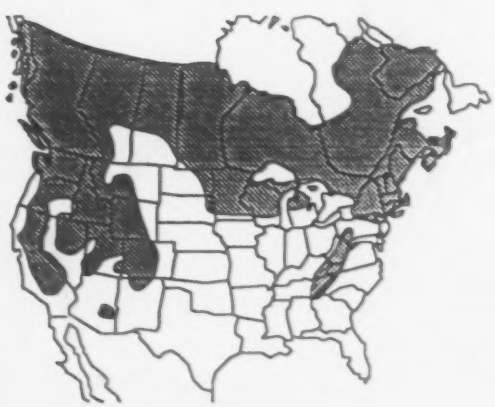
MASSACHUSETTS RARE AND ENDANGERED WILDLIFE

Water Shrew
(Sorex palustris)

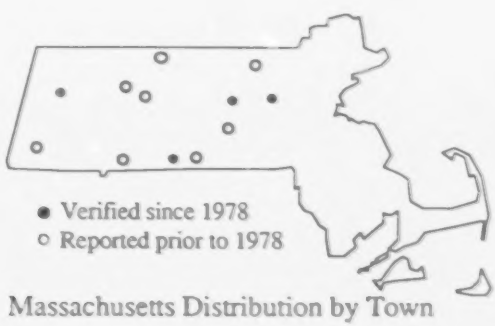
DESCRIPTION: The Water Shrew is the largest long-tailed shrew found in New England. Its size ranges from 144 to 158 mm (5.7 to 6.2 in.). Its long tail accounts for almost half of its total length. Both the tail and body of the Water Shrew are dark colored on top and lighter grey underneath. Some of the hairs on the back are tipped with silver and the lips and chin are often white. The most remarkable feature of the Water Shrew is its broad hind feet. The toes and sides of these feet are bordered by stiff hairs which, along with the slightly webbed toes, make the species a powerful swimmer.



SIMILAR SPECIES: Five other species of shrews inhabit Massachusetts: the Masked Shrew (Sorex cinereus), Smoky Shrew (Sorex fumeus), Rock Shrew (Sorex dispar), Pygmy Shrew (Sorex hoyi), and Short-tailed Shrew (Blarina brevicauda). The Water Shrew is distinguishable from all of these because it is the only long-tailed shrew that has long hairs along the margins of its hind feet.



Range of Water Shrew



Massachusetts Distribution by Town

1991

RANGE: The Water Shrew occurs in all of the southern Canadian Provinces. It occurs on both U.S. coasts; south along the Sierra and Rocky Mountain ranges in the West and down the Appalachians to North Carolina in the East. It has been found in all of the New England states, although in Massachusetts it has only been documented at a dozen locations.

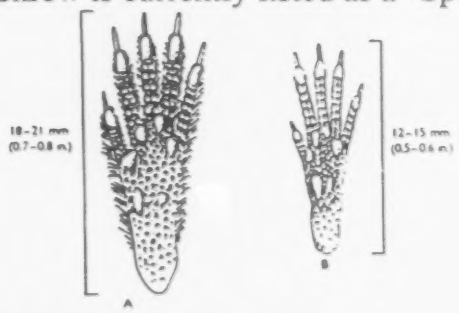
HABITAT IN MASSACHUSETTS: The Water Shrew lives on the banks of streams, lakes, and ponds, usually near boreal or mixed forests. It makes its nest from dried moss or other vegetation tucked away in a streamside burrow, rocky crevasse, or among the tangled roots of wetland trees. Potential Water Shrew habitat occurs throughout most of Massachusetts.

REPRODUCTION: Male Water Shrews breed in their second spring, but females have been known to breed in their first summer in cases of low population density. Breeding activity usually begins in February and continues into August. A female may rear 2 or 3 litters in the course of one breeding season. A single litter contains an average of six offspring. Gestation lasts approximately 20 days. The young are weaned in 3 weeks.

DIET: The Water Shrew preys on a variety of aquatic and terrestrial animals. Its diet includes snails, earthworms, flatworms, insect larvae, small fish, fish eggs, and crayfish. Insects form the bulk of its diet.

BEHAVIOR: The Water Shrew lives a solitary life. It is primarily nocturnal although it is active on cloudy days or in well shaded areas. It spends much of its time in the water where it is an excellent swimmer assisted by paddle-like hind feet and a protective layer of air that becomes trapped in its fur. Due to air bubbles that become trapped in the hair of its toes, it can actually run across the water for short distances. Its eyesight is poor and it hunts by using its senses of touch, hearing, smell, and possibly echolocation. It is most commonly observed by humans while running along rocky streambanks at dusk.

POPULATION STATUS IN MASSACHUSETTS: The Water Shrew has not been observed often in Massachusetts. However, there have been few deliberate searches for this shrew in the state and its reclusive habits make it difficult to encounter by chance. Therefore, very little is known about its actual distribution and abundance in the state. Threats to the Water Shrew include the loss of wetland habitats and potentially the introduction of new predators such as small-mouth and large-mouth bass. The Water Shrew is currently listed as a "Species of Special Concern" in the state.



A. Hindfoot of a water shrew showing fringe of hairs.
B. Hindfoot of a smoky shrew.

Merritt, J.F.. Guide to the Mammals of Pennsylvania.
1987. Univ. Pittsburgh Press.

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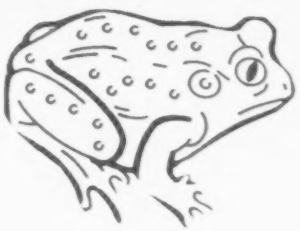
MASSACHUSETTS RARE AND ENDANGERED WILDLIFE

EASTERN SPADEFOOT
(Scaphiopus h. holbrooki)



DESCRIPTION

The Eastern Spadefoot Toad, only 1.75-2.25" (4.4-5.7cm) long, is a short-legged, squat, big-headed toad. The unmistakable cat-like, vertically elliptical pupils are distinctive. The skin is fairly smooth and scattered with small warts. Colors are somber, grayish or blackish-brown with olive. Two yellowish lines originate from each eye and run down the back to form a lyre-shaped pattern. Another light line runs along each side of the body. The toad's name comes from the horny, sharp-edged, sickle-shaped spade on the inner surface of the hind foot. It belongs to a primitive amphibian family that is neither a true frog nor a true toad.

SIMILAR SPECIES

The Eastern Spadefoot is the only toad in its family occurring east of the Mississippi River. It is distinguished from the true toads by its smoother skin, vertically elliptical pupils and single, sharp-edged spade on each hind foot.

HABITAT IN MASSACHUSETTS

This burrowing species requires dry, sand or sandy loam soils characteristic of Pitch Pine barrens, coastal oak woodlands or sparse shrub growth, interspersed with temporary ponds. It prefers areas with leaf litter, and may be found in farmland areas. Colonies may occur within the floodplains of major rivers.

BEHAVIOR

The Eastern Spadefoot is the most fossorial species of frog or toad in Massachusetts. It burrows up to eight feet below the ground's surface

(continued overleaf)

Range of Scaphiopus h. holbrooki

BEST COPY AVAILABLE

● Verified since 1978
○ Reported prior to 1978

Breeding Distribution in Massachusetts by Town

to hibernate during the cold months and to avoid desiccation during the rest of the year. It backs down into its burrow, digging with the hind feet and covering itself over with the fore feet. In the warmer months, from April to September, the Spadefoot comes up to breed after prolonged warm and heavy rains. Spadefoots are secretive and nocturnal; activity peaks just after sundown and before sunrise. In the summer months, individuals remain in their burrows an average of 9.5 days between feedings. They emerge uttering explosive, low-pitched grunts, short in duration and repeated at brief intervals. Home range movements are estimated to be an average of 108 sq. ft./10 sq. m., 90% of which falls within an area of 67 sq. ft./6.2 sq. m. Spadefoots have been recaptured in the same ranges after 5 years. Individuals may live for several decades. Adults apparently produce noxious or distasteful skin secretions, because native predators usually ignore them.

BREEDING SCHEDULE

Colonial breeding is initiated by heavy rainfall in April or May and lasts until August or September. This one or two night phenomenon has been likened to an orgy of raucous squawks and frantic courtship. Since Spadefoots do not breed successfully in permanent waters with fishes, they breed in temporary ponds. The adhesive eggs, laid in masses or strings of 1000-2500, are draped over submerged twigs or grass, where they hatch in 5 to 15 days. Metamorphosis of larvae to adults is said to coincide with pond conditions; longer pond life results in longer larval life. In Essex County, a natural population metamorphosed in less than 4 weeks. Sexual maturity is reached during the second year after metamorphosis, males at 15 months and females at 19 months.

FEEDING HABITS

Larvae feed on plankton for the first few days, later becoming vigorously carnivorous and sometimes cannibalistic. Adults eat flies, spiders, crickets, caterpillars, true bugs, other ground-dwelling arthropods, earthworms, snails, moths, and small vertebrates, such as salamanders.

RANGE

The Eastern Spadefoot Toad is found from Massachusetts to New York, south to eastern Florida and some of the Keys, west through Pennsylvania, through the southern Great Lakes region, to Arkansas and south to Louisiana. The species is absent from the higher elevations of the Appalachians and the Everglades. In Massachusetts, the Spadefoot is known only in scattered coastal locations from Plum Island, south to Cape Cod and Martha's Vineyard and several locations in the southern Connecticut Valley.

STATUS

The Eastern Spadefoot is listed as "Threatened" in Massachusetts. Only 12 current sites have been verified since 1978. Museum specimens and literature attest to the former widespread, if not abundant, status of the species. Several factors contribute to the rarity of the species. Plum Island is the northern limit of species' range. Destruction of suitable habitat continues to limit its numbers; Spadefoot populations have been extirpated by development from Middlesex County, inland Essex County and parts of Martha's Vineyard. The species is vulnerable to pesticides, as it was extirpated in Nantucket after WWII by the use of DDT. Many individuals are killed crossing roads, especially during the breeding season.

Adapted from: Lazelle, J.D., Jr., 1987. Eastern Spadefoot. In T. W. French and J. E. Cardoza (eds). Endangered, Threatened, and Special Concern Vertebrates of Massachusetts. Massachusetts Division of Fisheries and Wildlife (in press).

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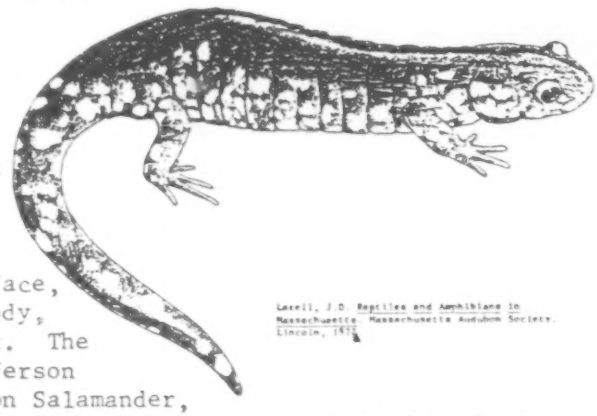
MASSACHUSETTS RARE AND ENDANGERED WILDLIFE

BLUE-SPOTTED SALAMANDER

(Ambystoma laterale)



Lazell, J.D. Reptiles and Amphibians in Massachusetts. Massachusetts Audubon Society. Lincoln, 1972.

DESCRIPTION

The Blue-spotted Salamander is a long, 4-5½" (10-13cm.), amphibian that lives its entire life underground, except for a short breeding period. It has a slender body, narrow snout, short limbs, and long digits. It is characterized by dark gray-to-black dorsal pigmention with a paler ventral surface, sky-blue spots on the lower sides of the body, and black pigmentation surrounding the vent. The Blue-spotted Salamander is part of the Jefferson Salamander Complex, along with the Jefferson Salamander, the Silvery Salamander, and Tremblay's Salamander; the Silvery and Tremblay's forms are thought to have originated from the hybridization of the Jefferson and Blue-spotted forms.

ECOLOGY/BEHAVIOR

Habitat

The Blue-spotted Salamander is usually found in relatively mature deciduous forests with vernal (temporary) ponds, full of dead and decaying leaves for cover and shrubby plants for egg deposition. Roadside ditches, small kettle holes, and small depressions also provide habitat when flooded in the spring.

Migration

Adults burrow underground or beneath leaf litter for most of the year but are thought to remain within 500 meters of their breeding ponds.

(continued overleaf)

Distribution of Blue-spotted Salamander

● Verified since 1978
○ Reported prior to 1978

Breeding Distribution in Massachusetts by Town

Breeding Habits

In spring (mid-March-late-April), on warm rainy nights, the salamanders migrate above ground to ponds to breed. The female lays eggs in a series of gelatinous masses at the bottom of the pond. Hatching about a month later, the larvae are voracious carnivores, preying on mosquito larvae and other small aquatic animals. By mid-August the larvae have metamophosed into air-breathing adults. At this stage they crawl into the leaf litter and burrow underground.

Feeding/Other Behaviors

Blue-spotted Salamanders feed on insects, spiders, worms, and centipedes. The adults produce noxious skin secretions, from specialized poison glands, and are therefore rarely preyed upon by native predators.

RANGE

The Blue-spotted Salamanders range from the northern shore of the Gulf of St. Lawrence across southern Canada to Lake Winnipeg and south to New England, New York, and the northernmost parts of Ohio, Indiana, and Illinois; also disjunct colonies in Labrador, Long Island, northern New Jersey, and Iowa.

POPULATION STATUS

The Blue-spotted Salamander is considered a species of "Special Concern" in Massachusetts. Thirty-five current (1978 to present) occurrences have been verified; historically 23 other occurrences have been recorded. The species occurs more commonly in eastern Massachusetts than elsewhere in the state. Population declines are suspected because of habitat destruction, and acid rain precipitation may pose a serious threat to the survival of eggs and larvae.

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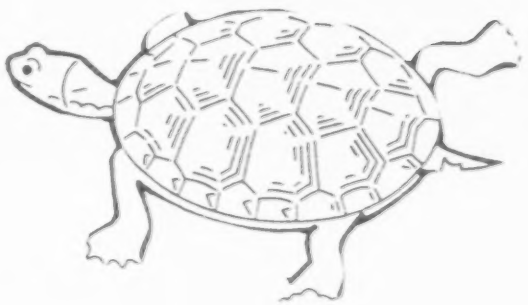
MASSACHUSETTS RARE AND ENDANGERED WILDLIFE

Wood Turtle
(Clemmys insculpta)

DESCRIPTION: The Wood Turtle is the largest member of its genus, ranging from 14.0 to 22.9 cm (5.8 to 9.0 inches) in length. Each segment of its brown upper shell rises into an irregular pyramidal shape, and is marked with a pattern of concentric ridges and radiating grooves resembling a spider web or growth rings on a tree stump. The turtle's lower shell is yellowish, with black splotches along the sides, one on each segment. The lower shell of a male turtle is concave for mating purposes. The head of a Wood Turtle is black, and the tail and legs are black or brown on the upper surface. The throat and lower surface of the tail and legs may be red, orange, or yellow. Male Wood Turtles are usually larger than the females, and have longer, thicker tails.



SIMILAR SPECIES: The habitat of Eastern Box Turtles and Blanding's Turtles may overlap that of the Wood Turtle, but neither has pyramidal shell segments like the Wood Turtle. The Northern Diamondback Terrapin has a shell similar to that of the Wood Turtle, but it only lives near saltwater, which the Wood Turtle avoids.

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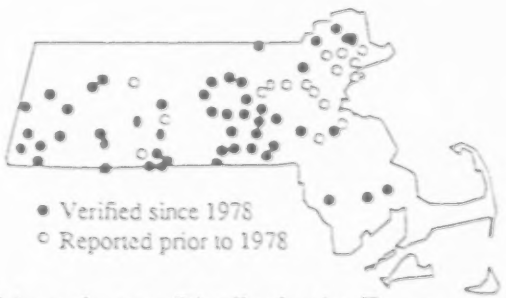
Range of Wood Turtle



Massachusetts Distribution by Town

RANGE: The Wood Turtle can be found throughout New England, north to Nova Scotia, west to eastern Minnesota, and south to northern Virginia.

HABITAT IN MASSACHUSETTS: Wood Turtles prefer forested areas next to unpolluted, meandering streams; they can also be found near rivers, bogs, and swamps. In the summer, they may leave their water source and wander long distances into woods, fields, farmland, and roadsides.

BEHAVIOR/ECOLOGY: Wood Turtles are most active by day; they can often be seen basking on a log or muddy streambank. A Wood Turtle basking on land can be very difficult to spot, since it often partially buries itself, concealing its body outline. When leaving water, Wood Turtles almost always throw dirt or sand over their shells with their front feet; hatchlings display this behavior immediately after leaving the nest. They are omnivorous, eating a variety of foods such as clams, carrion, insects, fish, frogs, grass, moss, dandelions, and berries. Wood Turtles sometimes exhibit "stomping behavior": they stomp on the ground with their front feet, creating vibrations in the ground which cause earthworms to rise to the surface; the earthworms are then eaten.

Wood Turtles mate in both spring (late March to May) and autumn (October). Mating usually occurs in the water. From 4 to 12 smooth white eggs, about 3.4 cm (1.4 in.) in length and 2.4 cm (.95 in.) in width, are laid in a nest in May or June. The nest is a depression dug by the female in gravel or sandy soil, which is frequently but not always near water. The eggs usually hatch in August or September, sometimes as late as October.

Adult Wood Turtles often leave their water source during the summer, but always return in autumn, where they mate and then hibernate in communal groups from late autumn to March or April. Muddy banks, stream bottoms, deep pools, decaying forest vegetation, and abandoned muskrat burrows can all serve as hibernation sites. Wood Turtles have long life spans, sometimes exceeding 50 years.

POPULATION STATUS: Wood Turtles are listed as a species of Special Concern in Massachusetts. Population decline of Wood Turtles has been caused by pollution of streams, development of wooded streambanks and extensive commercial collection of specimens. Highway deaths take a heavy toll on adult Wood Turtles; coyotes are also known to prey on adults. Predation of eggs and young by raccoons, skunks, cats, and dogs is also a serious problem.

Natural Heritage & Endangered Species Program

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MASSACHUSETTS ENDANGERED WILDLIFE

Peregrine Falcon
(Falco peregrinus)

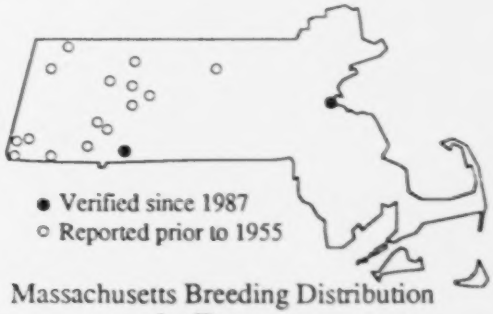
DESCRIPTION: The Peregrine Falcon is the fastest bird on earth, capable of diving from great heights at speeds of up to 200 miles per hour. It is a beautiful raptor with long, pointed wings and a long, slightly rounded tail. Adults have a bluish-gray to slate-gray backside and a buffy white underside interspersed with black. Adults also possess a black crown, black moustache-like markings or "sideburns", a white throat, a dark bill with a prominent yellow fleshy base (or cere), and yellow legs and feet. Immature Peregrines have a brown backside and heavily streaked underside. Peregrines are medium-sized falcons; males are slightly smaller than a crow (0.4 to 0.45 m (15 to 18 inches) in length) with a wingspan of 0.9 to 1.1 m (35 to 42 inches), while females are slightly larger than a crow, reaching a length of 0.45 to 0.5 m (18 to 20 in.) with a wingspan of 1.1 to 1.2 m (42 to 48 in.).

SIMILAR SPECIES IN MASSACHUSETTS: The only falcon which might be confused with the Peregrine Falcon is the Merlin (Falco columbarius). However, the Merlin is smaller than the Peregrine (0.25 to 0.35 meters, or 10 to 14 inches), does not have the Peregrine's dark "sideburns", and possesses a conspicuously banded tail. Furthermore, the Merlin's habitat consists of coniferous forests adjacent to open clearings, which is substantially different from Peregrine habitat. Merlins do not breed in Massachusetts but pass through the state during migration and overwinter in small numbers.

(continued overleaf)

Range of Peregrine Falcon in North America
(reintroduced at various sites within its former breeding range in the eastern U.S.)

- Winter range
- Summer (breeding) range
- Year-round range



- ● Verified since 1987
- ○ Reported prior to 1955

Massachusetts Breeding Distribution by Town

HABITAT IN MASSACHUSETTS: The Peregrine Falcons which currently breed in Massachusetts utilize artificial nesting platforms high up on tall buildings in heavily urbanized areas (Boston and Springfield). Historical Peregrine nesting sites (eyries) within Massachusetts were located on rocky cliffs. In general, Peregrine Falcons prefer to nest on cliffs overlooking a body of water, but they will occasionally nest on skyscrapers, towers, and bridges.

RANGE: The Peregrine Falcon is one of the most widely distributed birds in the world, inhabiting every continent except Antarctica. Unfortunately, the species has substantially declined world-wide, due primarily to the effects of the pesticide DDT. In North America, Peregrines once bred from Alaska and northern Canada to Georgia and California. They are now largely restricted to breeding in Alaska, Canada, and the western United States. All of the breeding Peregrine Falcons in the eastern half of the U.S. were extirpated by 1966. Reintroduction efforts beginning in 1975 resulted in the establishment of over 80 breeding pairs in the East by the end of 1990. Greater numbers of Peregrine Falcons can be seen in the East during migration, which peaks in early October.

LIFE CYCLE / BEHAVIOR: Peregrine Falcons migrate to their nesting sites in early March. They often use the same nest site year after year, and mate for life. Peregrines do not actually build a nest; they only scrape out a shallow hollow for the eggs in order to prevent them from rolling off the cliff or skyscraper where they are laid.

The female Peregrine normally lays 2 to 6 (typically 4) creamy brown eggs sometime in April or May; the eggs are incubated by both parents until they hatch 28 to 32 days later. If the first clutch of eggs is destroyed, a second clutch is usually laid.

Young Peregrines begin to fly 30 to 40 days after hatching, but do not breed until they are three years old. The two breeding pairs of Peregrines within Massachusetts overwinter in the state, but Peregrine Falcons from higher latitudes migrate to South America in late August to October for the duration of the winter.

Peregrine Falcons in Massachusetts prey primarily on starlings and high-flying migratory birds; they may also hunt pigeons, blue jays, shorebirds, robins, and many other small to medium-sized birds. Peregrines prefer to catch their prey in flight by diving into them at tremendous speeds and killing them with their sharp talons.

POPULATION STATUS: The Peregrine Falcon is listed as an Endangered Species at both the state and federal levels; approximately 15 historic (all before 1955) breeding sites and only 2 current breeding sites have been documented for this species in Massachusetts. None of the historic eyries is currently utilized.

Peregrine Falcons once inhabited the Berkshires as well as the Housatonic and Connecticut River valleys until the 1950's, when the insecticide DDT began to be widely used. DDT contaminated thousands of insects and fish, which were then ingested by birds, which in turn were eaten by Peregrine Falcons; as a result, high concentrations of DDT built up inside the Peregrines' bodies.

DDT prevented female Peregrines from metabolizing enough calcium to produce hard eggshells, so the eggs usually broke when the parents tried to incubate them. Consequently, the Peregrine Falcon population in the United States suffered a sudden and catastrophic decline, resulting in the total extirpation of the species from the eastern United States. The last breeding pair in Massachusetts was seen in 1955.

Beginning in the mid-1970's, captive breeding programs and reintroduction efforts have restored the Peregrine Falcon to some small areas of its former range in the U.S., but there is still a very long way to go before the Peregrine approaches its former status. In Massachusetts, young captive-bred Peregrines were released in Boston in 1984 and 1985, and in Amherst in 1988. A pair of Peregrines has successfully bred in Boston, and another pair has bred in Springfield; both pairs have laid eggs this year. Nearly two dozen breeding pairs have also been established in northern New England and New York. DDT was banned in 1972, but small amounts are still present in the environment. There are also other threats to the Peregrine Falcon, primarily human disturbance of nesting sites which may cause a breeding pair to abandon its nest, collisions with airplanes, and predation on nestlings by Great Horned Owls.

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MASSACHUSETTS RARE AND ENDANGERED WILDLIFE

Golden-winged Warbler
(Vermivora chrysoptera)

DESCRIPTION: The Golden-winged Warbler is a beautiful bird, about 11 cm (4.5 in.) in length, with a distinctive combination of colors and patterns. The male has a dull white underside and a gray back, with bright yellow patches on the crown (forehead) and upper wing surfaces, and a black throat and bill. A black "mask" extends across the eyes, with patches of white above and below the mask. The female Golden-winged Warbler is similar in appearance, but the colors are considerably duller. Male Golden-winged Warblers sing most persistently in the morning early in the nesting season. Golden-wings make use of two types of songs. One of the songs is characterized by a high-pitched buzzy phrase followed by 1 to 6 shorter buzzy phrases, and is used to attract mates. The other song consists of 3 to 5 low buzzy phrases ending with a higher buzzy phrase, and is used to defend the bird's territory against other males.

SIMILAR SPECIES: The Blue-winged Warbler is a very close relative of the Golden-winged Warbler, but its body is predominantly yellow instead of gray and white. These two species of warblers often mate and produce hybrids, one of which is known as Brewster's Warbler. It is very similar in appearance to the Golden-winged Warbler, but has a yellow patch on its chest and lacks black throat color; its mask is also less conspicuous. The other hybrid, known as Lawrence's Warbler, has a yellowish head and underside, black throat and mask, and two white wingbars.

HABITAT IN MASSACHUSETTS: Golden-winged Warblers prefer woodland edges bordering early successional clearings (such as abandoned farmland and powerline areas), heavily overgrown with patches of grass, weeds, bushes, shrubs, briars, and small trees. Common species of vegetation found in these habitats are grapevine (Vitis sp.), goldenrod (Solidago sp.), and birch (Betula sp.).

(continued overleaf)

Summer (breeding) range

Massachusetts Distribution by Town

1990

BEST COPY AVAILABLE

RANGE: The summer range of the Golden-winged Warbler extends from southern New Hampshire west to Minnesota and south to Iowa and New Jersey (and in the Appalachians to northern Georgia). During the early part of the century, the Golden-winged Warbler's summer range expanded northward and eastward but it disappeared from the southern extent of its range. The winter range of the Golden-winged Warbler extends from southern Mexico to Venezuela and Colombia.

BEHAVIOR / ECOLOGY: Golden-winged Warblers usually arrive in New England in early May, the females arriving a day or two later than the males. The males immediately set up territories (which range in size from 1 to 5 acres) and sing in order to defend their territory and attract females. Males often return to the same site year after year. After pairing takes place, the females build bulky nests on or near the ground. The nest is constructed out of grasses, leaves, vine tendrils, and other fine materials, and is supported by bushes, or very frequently, by goldenrod stems. From mid-May to mid-June, three to seven creamy white eggs with brown speckles are laid, one egg per day. The eggs are incubated by the female for 10 to 11 days. Both parents feed and care for the nestlings. Although the chicks are able to leave the nest after ten days, the parents continue to care for them until several weeks afterward. The chicks acquire their winter plumage about a month after birth, and reach maturity in one year. Golden-winged Warblers begin their southward migration in late August or early September. Golden-winged Warblers feed on larvae, small bugs, spiders, ants, beetles, and caterpillars (including Gypsy Moth caterpillars). The Golden-winged Warbler's feeding behavior resembles that of chickadees: it hops from twig to twig, sometimes hanging upside down, while peering about around the branches for insects. The life span of the Golden-winged Warbler is about 2 to 5 years.

POPULATION STATUS: The Golden-winged Warbler is listed as an Endangered species in Massachusetts due to its rapidly decreasing population; in fact;, there is no longer a viable population anywhere in Massachusetts. In the 19th century, Golden-winged Warblers were rarely seen in New England. In the early 1900's, the population of Golden-winged Warblers in New England increased as many farmlands were abandoned. From then until 1940, Golden-winged Warblers were locally uncommon to common in Massachusetts, and Blue-winged Warblers were not present. Since 1940, Blue-winged Warblers increased steadily in numbers throughout the state, and have become common in many areas. At the same time, the number of Golden-winged Warblers has steadily declined to the point where they are now rare throughout Massachusetts, and completely absent over most areas. It appears that the Blue-winged Warblers may have been swamping the gene pool of the Golden-winged Warblers by interbreeding with them. The courtship calls and displays of each species are very similar. As a result, Golden-winged Warblers often mate with Blue-winged Warblers, creating hybrids instead of true Golden-wings. However, Blue-winged Warblers also seem to be declining after reaching a zenith in the early 1980's.

Cowbird parasitism and loss or impairment of wintering habitat may also be part of the problem, but no one really understands exactly what happened to the Golden-wing; it is possible that the situation could reverse itself someday. The amount of suitable habitat for the Golden-wing does not seem to be a limiting factor; there is plenty of habitat available, but no birds to occupy it; many of the sites where Golden-winged Warblers have been seen since 1978 now appear to be abandoned. The only Golden-wings currently observed in Massachusetts are stray males which establish a territory in suitable habitat, advertise (usually without success, since there are no Golden-wing females around) and depart southward in autumn. The male, if still alive, will return to the exact same territory the following spring and try again. After the male dies (in 2 to 3 years), the habitat is again vacant. The likelihood of another male turning up in the same place is extremely small; usually the next pioneering male will pick somewhere else, and the discouraging cycle will repeat itself. Lately, so few Golden-wings turn up in Massachusetts that one can no longer expect to see them anywhere without a lot of luck.

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MASSACHUSETTS ENDANGERED WILDLIFE

Northeastern Beach Tiger Beetle
(Cicindela dorsalis dorsalis)

DESCRIPTION: The Northeastern Beach Tiger Beetle is an active coastal predator, approximately 13.0 to 15.5 mm (0.5 to 0.6 inches) in length, with a bronze green head and thorax, long slender legs, and white or tan elytra (wing covers) which are often finely imprinted with dark lines. Tiger beetles are so named because of their "tiger-like" behavior of chasing down prey and capturing the victims with their long mandibles.

The larval form of the Northeastern Beach Tiger Beetle is pale in color, with one pair of antennae on the head, an iridescent black and green pronotum (analogous to a "neck") covered with setae (hairs), and a long segmented abdomen.

SIMILAR SPECIES IN MASSACHUSETTS: The Northeastern Beach Tiger Beetle is one of four subspecies of C. dorsalis; however, none of the other three subspecies occurs in Massachusetts, and it is not easily confused with other tiger beetle species occurring in the state. Cicindela hirticollis is found on coastal beaches, including the single beach in the state inhabited by C. dorsalis dorsalis; however, its elytra are much darker and differently patterned. C. lepida more closely resembles C. dorsalis dorsalis because it also has white elytra but its body is more slender and much smaller in size; furthermore, this species has been documented in the state only once, over 75 years ago.

RANGE: The Northeastern Beach Tiger Beetle is very restricted in range. Historically it could be found along the Atlantic coastline from Massachusetts to Virginia. Today, it is found only at the extremes of its former range, in the Chesapeake Bay area adjacent to Maryland and Virginia, and a single beach on one of Massachusetts' offshore islands.

Current Range of
Northeastern Beach Tiger Beetle

HABITAT IN MASSACHUSETTS: In general, C. dorsalis dorsalis requires large, highly exposed beaches with fine sand particles and a low amount of human disturbance. The sole population of Northeastern Beach Tiger Beetles in Massachusetts inhabits an exposed offshore barrier beach, ranging in width from 15.5 to 34 meters (50 to 110 feet), with a mixture of high, well defined dunes and low, unstable dunes at the upper end of the beach. The predominant form of vegetation on the dunes and upper beach is beach grass (Ammophila breviligulata). The beach is relatively pristine and undisturbed by human activities.

(continued overleaf)

1991

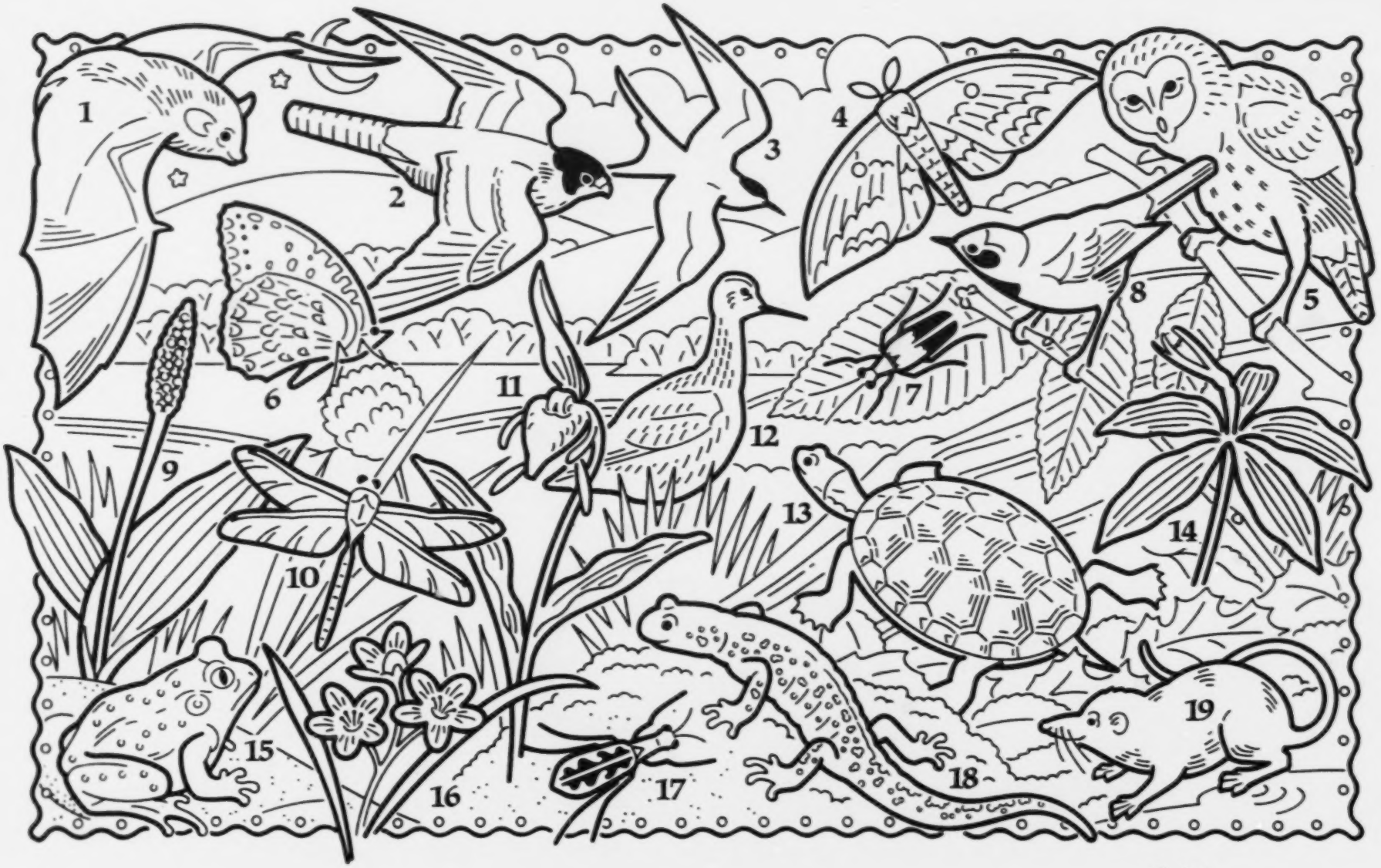
LIFE CYCLE / BEHAVIOR: Emergence of adult Northeastern Beach Tiger Beetles occurs from early June to mid-August, peaking in mid-July. The adults forage in the intertidal zone where they scavenge on dead fish and prey on invertebrates for much of their food. They are primarily diurnal, but they are also quite active at night from mid-July to late August. Mating occurs from late July to early August, after which the female Northeastern Beach Tiger Beetles oviposit (lay their eggs) in the intertidal zone. By September, most if not all of the adult beetles have died.

Northeastern Beach Tiger Beetles have a two-year life cycle. Older larvae (2nd and 3rd "instars" or larval stages) which overwintered first appear in late May and June, while 1st instar larvae appear in mid-August. The larvae dig tiny vertical burrows in the sand. The position of the burrows changes over the course of the year; in late spring, the burrows of larvae that have overwintered are located well up the beach near or beyond the edge of vegetation. In midsummer, the burrows of young recently-hatched larvae are within a few meters of the high-tide line; by autumn, the burrows are once again at the upper end of the beach. The changes in larval burrow location parallel the erosion-accretion cycle of the beach: the beach widens in the summer as sand is deposited, and narrows in the fall and winter as stronger winds and waves transport the sand offshore. The depth of the burrows also increases with each successive instar.

Older larvae appear to be dormant through much of the summer, but the young larvae are extremely voracious. Their sensory organs can detect the vibrations made by nearby invertebrate prey; when the prey is close enough, the larval tiger beetle's head lunges out of its burrow opening and captures its victim with its strong serrated jaws, then drags it into the burrow and devours it. Larvae develop through 3 instars and overwinter twice before finally emerging as adults. The primary food of larvae is "sand fleas" (amphipods), which can be very numerous and occur in wet sand and under the sea-wrack.

POPULATION STATUS IN MASSACHUSETTS: The Northeastern Beach Tiger Beetle is classified as an Endangered species in Massachusetts and is also federally classified as Threatened. Only one current site has been documented in the state for C. dorsalis dorsalis. The Northeastern Beach Tiger Beetle formerly inhabited several beaches on outer Cape Cod and a number of the offshore islands, but it has not been found at any of these beaches (with one exception) for many years. Increased human recreational pressure on these beaches, particularly intensive off-road vehicle traffic, is believed to be largely responsible for the disappearance of these populations, as well as many others along the Atlantic Coast. ORV's can kill adults and larvae directly by crushing them. ORV's also can continually damage the larval burrows; as a result, the larvae must reduce their feeding time and expend a considerable amount of energy to repair the burrows.

The proximity of the larval burrows to the high-tide line in mid-summer increases their chance of being washed away; a severe storm or early season hurricane at this time could potentially wipe out the entire state population; this likelihood makes the probability of extinction very high.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KEY TO ENDANGERED SPECIES

1. Indiana Myotis
2. Peregrine Falcon
3. Roseate Tern
4. Imperial Moth
5. Barn Owl
6. Regal Fritillary
7. Elderberry Borer
8. Golden-winged Warbler
9. Golden Club
10. Comet Darner
11. Ram's-head Lady-slipper
12. Upland Sandpiper
13. Wood Turtle
14. Small Whorled Pogonia
15. Eastern Spadefoot Toad
16. Narrow-leaved Spring Beauty
17. Northeastern Beach Tiger Beetle
18. Blue-spotted salamander
19. Water Shrew

Massachusetts Audubon Society